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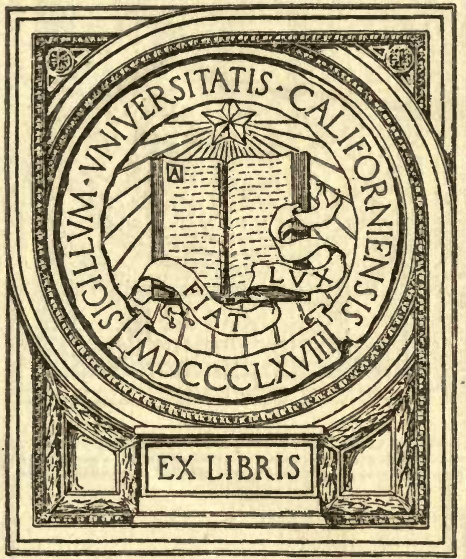

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Pamphlets on forestry in Michigan

MICHIGAN FORESTRY PAMPHLETS

VOL. VII

Announcement of work in Botany and Forestry Univ. of Mich., Dept. of Literature, Science and the Arts. 1902-1903.

Announcement of work in Forestry, 1903-1904
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UNIVERSITY BULLETIN
New Series. Vol. III. No. 17.

UNIVERSITY OF MICHIGAN

Walter Mulford

DEPARTMENT OF

LITERATURE, SCIENCE, AND THE ARTS

ANNOUNCEMENT OF WORK IN

BOTANY AND FORESTRY

1902—1903

ANN ARBOR, MICH.
PUBLISHED BY THE UNIVERSITY

OFFICERS OF ADMINISTRATION AND INSTRUCTION.

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BOTANICAL LABORATORY.

In the botanical laboratory instruction is given in the practical study of the structure, development, and physiology of plants, and opportunity is offered for investigation in cellular biology, in embryology, physiology, and pathology. Provision has also been made for graduate students entering upon the professional study of forestry to carry on special work in botany.

The library contains approximately 3,000 bound volumes of exclusively botanical books, 2,000 volumes of which are shelved in the laboratory. These include the leading American, English, German, and French botanical periodicals, among which are the Annals of Botany, Botanical Gazette, Journal of the Linnæan Society, Botanische Zeitung, Botanisches Centralblatt, Botanischer Jahresbericht, Flora, Jahrbücher für wissenschaftliche Botanik, Annales des Sciences naturelles, Bulletin de la société botanique de France, Annales du jardin botanique de Buitenzorg, and others.

The laboratory comprises four large rooms for general work, five smaller rooms for the work of instructors and investigators, a room for alcoholic material, a dark room and store rooms. The section assigned to morphology and cytology is provided with high grade microscopes, cameras, and polarizing apparatus; Cambridge, Minot-Zimmerman, Jung, and freezing microtomes; sterilizers, means for embedding, Wardian cases, aquaria, and photographic apparatus. The equipment for physiology, besides rooms provided with chemicals and general apparatus, includes a dark room with constant temperature, incubators, sterilizers, refrigerator, horizontal microscopes, balances, thermograph, barometers, auxanometers, klinostats, and centrifuges. The heavier apparatus is driven by electric and water motors. A plant house affords space for work under glass.

The University herbarium, with 100,000 specimens, and the botanical garden include a large proportion of the plants indigenous to Michigan, besides many foreign species. The collection of fungi includes Briosi and Cavara's Funghi Parasiti, Seymour and Earle's Economic Fungi, Ellis's North American

Fungi, and an extensive series of Michigan Fungi. There is also a large collection of material mounted in alcohol and formalin, or otherwise prepared, illustrating the biological relation of plants.

In addition to laboratory facilities, the vicinity of the Huron River and a number of glacial lakes, with natural forests within walking distance, offer excellent opportunities for field work. A botanical survey of the Huron Valley is in progress, and a limited number of students are assigned special studies of the plant societies here represented.

DESCRIPTION OF COURSES.

The courses in botany are arranged in three groups:

I. Primarily for undergraduates (Courses 1 and 2 in General Biology and Courses 1, 2, 4, and 6 in Botany).

II. For graduates and undergraduates (Courses 7, 8, 10, 11, 12, 13, 14, 15, and 16).

III. For graduates (Courses 17, 18, 19, 20, 21, and 22).

Students intending to make a specialty of botany should acquire as soon as possible a reading knowledge of German and French. They should also pursue, early in the undergraduate work, the elementary courses in physics and chemistry.

As introductory to the work in botany all students are required to take a year in general biology. The work of the botanical Courses 1 and 2 is identical with the botanical portion of the courses in general biology.

While all of the courses in botany, with the exception of Course 6, are non-technical and may properly form a part of a general education, certain courses afford special preparation for students who expect to teach or to engage in other lines of professional work.

Those who intend to teach botany in the secondary schools should elect, as a minimum, Courses 4, 7, 10, 12, 13, 14 and 15; those looking to college positions should add to the foregoing courses numbers 8, 17 and 18, or 19 and 20, 21 and 22. For preparation for the work of public analysts of foods, etc., Course 6 should be taken; for professional work in plant pathology, Courses 4, 7, 8, 10, 13, some research in pathology under Courses 17 and 18, or 19 and 20, and Courses 21 and 22; for professional work in forestry, the student should lay a foundation with Courses 4, 7, 8, 10, 13 and 14.

Graduate students are not confined to courses, but they will often find the elementary work in general biology and in other courses of value.

I. COURSES PRIMARILY FOR UNDERGRADUATES.

GENERAL BIOLOGY.

The courses in general biology are carried on by coöperation between the departments of Botany and Zoology. These courses are introductory and are required as a preparation for all subsequent work in these departments.

FIRST SEMESTER.

1. Elements of Biology. A study of typical species of plants and animals with reference to structure, function, development, and relationship. *Four hours.* Assistant Professor JENNINGS and Dr. POLLOCK. Work in the botanical and zoological laboratories. *Hours to be arranged.*

The botanical part of this course consists of a study of a number of the simpler forms of plant life, chiefly algæ and fungi, the course serving as an introduction to the more advanced work in Cytology, Morphology, Physiology and Ecology.

In connection with this course use will be made of Campbell, University Text-Book of Botany, and the literature therein cited; Klebs, Fortpflanzungsphysiologie der niederen Organismen; De Bary, Fungi, Mycetozoa, and Bacteria; Strasburger, Noll, Schenck and Schimper, Text-Book of Botany; and Vines, Student's Text-Book of Botany.

SECOND SEMESTER.

2. Elements of Biology. Continuation of Course 1. *Four hours.* Dr. HOLMES and Dr. POLLOCK.

The botanical part of this course is devoted to the study of the developmental history of typical species of mosses, liverworts, ferns, and gymnosperms. The alternation of generations and evidences of genetic relationship constitute a leading feature of the work. In this course Campbell, Mosses and Ferns, will be used; also Goebel, Outlines of Special Morphology and Classification; Coulter and Chamberlain, Morphology of Spermatophytes; and Sedgwick and Wilson, General Biology.

BOTANY.

FIRST SEMESTER.

1. Elements of Biology (Plant Life). A study of the properties and activities of protoplasm, developmental history, evolution of structure and function, and relation to environment. *Two hours.* Dr. POLLOCK and Dr. BURNS.

Course 1 is equivalent to the botanical part of Course 1 in general biology, under which it is described. It is not to be elected separately by first year students, nor by others, except with the express approval of both instructors.

SECOND SEMESTER.

2. Elements of Biology (Plant Life). Continuation of Course 1, embracing the alternation of generations and general biology and physiology of liverworts, mosses, ferns, and gymnosperms. *Two hours.* Dr. POLLOCK.

Course 2 is equivalent to the botanical part of Course 2 in general biology, under which it is described. It may be taken as a separate course only by express permission of the instructors in charge of Course 2 in general biology.

4. Morphology of Flowering Plants. *Two hours.* Dr. BURNS.

In this course the embryology and development of flowering plants is taken up in a way to connect their history with that of the lower groups studied in Course 2. Attention will also be given to changes of habit and structure in adaptation to environment. Opportunity will be given for special study of species exhibiting such changes in their natural surroundings and under cultivation. Among the books most used in this course are: Campbell, University Text-Book of Botany; Engler and Prantl, Natürliche Pflanzenfamilien; and Vines, Student's Text-Book of Botany. Other useful works are: Geddes, Chapters in Modern Botany; Goebel, Pflanzenbiologische Schilderungen; and Goebel,Organography of Plants.

6. Elements of Structural Botany. *Three hours.* Assistant Professor SCHLOTTERBECK.

This course deals with cell-structure, cell-contents, the primary tissues, and, in general, the histological structure of plants, the object being to lay a solid foundation for the microscopical analysis of commercial preparations, including also the detection of adulterations, and an acquaintance with varietal characters of crude substances of vegetable origin.

In connection with this course, constant reference is made to Bastin, Laboratory Exercises; Tschirch und Oesterle, Anatomischer Atlas der Pharmakognosie und Nahrungsmittlelkunde; Tschirch, Angewandte Pflanzenanatomie; and Moeller, Pharmakognostischer Atlas.

II. FOR UNDERGRADUATES AND GRADUATES.

FIRST SEMESTER.

7. General Morphology and Physiology. *Five hours.* Professor NEWCOMBE.

The first five weeks of this course are given to the study of differentiation of plant members as related to function and external conditions, beginning with the simplest forms and progressing to the most complex. Considerable attention is paid to the physiological substitution of one member for another. The next six weeks are devoted to the study of the organs of the cell, cell walls, and cell contents. Here particular care is given to the structure and function of the various cell-plastids, of the nucleus, and of the cytoplasm. As nuclear and cell division are studied, the theories of heredity are discussed. Some time is given to the practical study of enzymes. The last three or four weeks of the semester are occupied with the study of the development of the mature plant from the embryo, the development of members, general anatomy and the functions of tissues.

Throughout the course, the student makes his own preparations, learning thereby the modern technique of embedding, cutting with the microtome, staining and mounting.

11. Experimental Physiology. Special Problems. *Two or more hours.* Professor NEWCOMBE.

The work of this course requires some degree of independence on the part of the student. It is to be preceded by *Course 10.* Special problems are assigned for research, these being intended to exercise and develop the ability of the student for severer original investigation.

13. Habits and Distribution of Plants. A review of recent literature on the biological relations of plants, accompanied by field studies. *Two or more hours.* Professor SPALDING.

In this course the habits and adaptations of plants in their native habitats will be studied in the field. At present the societies of aquatic and amphibious plants are receiving special attention, and forms that are adapting themselves to changes of water level and other varying factors are under investigation. In general outline the course corresponds to the ground covered by Schimper, Pflanzengeographie auf Physiologischer Grundlage. Reviews will be given of such ecological literature as MacMillan, Distribution of Plants at Lake of the Woods; Pound and Clements, Phytogeography of Nebraska; and recent papers of Cowles, Kearney, Bray, and others.

15. Experimental Morphology. Evolution of form and habit in adaptation to environment. *Two or more hours.* Dr. BURNS.

This course, which forms a natural sequence to Course 13, offers opportunity for more extended study of special cases of morphological adaptation under artificial as well as natural conditions. Changes of form and structure in Proserpinaca, Polygonum and other plants are under investigation together with certain aspects of zygomorphy and other problems of experimental morphology. Among the works most in use are Goebel, Organography of Plants; Haberlandt, Physiologische Pflanzenanatomie; Davenport, Experimental Morphology; and Goebel, Pflanzenbiologische Schilderungen.

SECOND SEMESTER.

8. Plant Pathology. Lectures and laboratory work. *Three hours.* Dr. POLLOCK.

In this course the aim will be to secure familiarity with the structure, habits, and life history of leading groups of fungi, special attention being given to those determining pathological conditions of cultivated plants. Sufficient time will also be given to bacteria and other pathological agents to secure a foundation for independent work in this direction. Among the works most used are v. Tubeuf, Diseases of Plants induced by Cryptogamic Parasites; De Bary, Fungi, Mycetozoa, and Bacteria; Schroeter, Die Pilze (in Engler and Prantl's Natürliche Pflanzenfamilien); and publications of the Division of Vegetable Pathology of the U. S. Department of Agriculture.

10. Experimental Physiology. *Five hours.* Professor NEWCOMBE.

This course includes for each week two lectures, considerable reading of general and special treatises on plant physiology, and from 8 to 10 hours of laboratory work. During the laboratory work the students are under the constant supervision of the instructor. They are assisted and advised in making preparations and in setting up apparatus. Typewritten laboratory guides are furnished each student, the experiments in which are, some of them, original, while others are selected from the practical physiologies of Sachs, Francis Darwin, MacDougal, Detmer, and others.

The subject-matter embraces: the application of physics and chemistry to the activities of living beings as manifested in imbibition, osmosis, diffusion, and respiration; the various nutritive processes of plants, such as their winning of food from the air and the earth, and its changes and destination in the plant body; the manner and means of the movement of gases and of solutions in plants; the means of plant growth and the influence of external conditions on growth; the sensitive reactions of plants to their environment, including their behavior toward gravitation, light, moisture, chemicals, gases, temperature, pressure, wounding, etc.

The whole work of the course is intended not only to give a general understanding of the facts and theories of plant physiology, but also to serve as a foundation for professional work in physiology, pathology, and forestry.

12. Systematic Botany. Studies of natural groups of the higher plants with reference to relationship and classification. *Two hours.* Dr. BURNS.

In this course field work will be carried on for the purpose of becoming acquainted with the ferns and flowering plants of Ann Arbor, and occasional excursions will be made to more distant places. Engler and Prantl, Natürliche Pflanzenfamilien; Gray, Manual of Botany; Britton, Flora of the Northern United States; and Sargent, Silva of North America are among the most important books used in this work.

14. Study of the local flora with reference to relationship and association of plant groups. *Two or more hours.* Professor SPALDING and Dr. BURNS.

In this course, which is given in connection with a botanical survey of the Huron Valley, excursions will be made and special attention given to the various plant societies represented in the vicinity. Students who are qualified for independent work will be given opportunity to study thoroughly a limited area with reference to the occurrence and sequence of plant societies, the habits of their members, and the factors by which these have been influenced or determined. Use will be made of Warming, Oekologische Pflanzengeographie; Pound and Clements, Phytogeography of Nebraska; Engler and Prantl, Natürliche Pflanzenfamilien; and ecological papers in recent periodicals.

16. Teachers' Conference and Field Club. *One hour.* In this course the time will be occupied during the first half of the semester with conferences and reports on lists of books, apparatus, and material for high school laboratories, and practical methods; during the second half of the semester, excursions will be made under the guidance of different members of the corps of instructors, for the purpose of learning methods of collecting and preserving material and conducting field observations. Professor SPALDING.

III. FOR GRADUATES.

FIRST SEMESTER.

17. Investigations in Physiology. Professor NEWCOMBE. Occasionally an undergraduate in his senior year is allowed to elect work in course under this heading. Such may elect *3 hours, 5 hours, 8 hours or 10 hours.*

The laboratory labors under the disadvantage of not occupying a building constructed for the purpose, but is, nevertheless, well equipped for work in general physiology and especially well equipped for certain lines of physiological work. There are incubators and sterilizers and glassware sufficient for work in plant diseases; there are balances, chemicals, glassware, etc., suitable for work in chemical biology; there are large aquaria and other facilities for the study of the biology of water plants, and nearby ponds, lakes and rivers for out-door work; there is electrical apparatus for studying the relations of plants to electricity; there are turning machines—klinostats and centrifuges—for studying the relation of organisms to gravitation and light. Electric and water motors supply power for turning trains of these machines, the present capacity being ten machines revolving in horizontal, vertical, or oblique planes, at speeds which can be regulated anywhere from .01 to 1,600 revolutions per minute.

19. Investigations in Morphology. Professor SPALDING.

The problems under investigation for several years past have been such as are included under the general head of experimental morphology, but with the practical work conducted as far as possible on plants in their natural habitat. Changes of structure and habit have been observed and recorded and various species are kept under observation with a view to collecting data with regard to the causes of variability and the permanence of specific characters. The works of De Vries, Vilmorin, Bailey, Bonnier, Faivre, Carrière, and De Candolle are among the most important for reference.

21. Current Literature of Botany. *One hour.* Professors SPALDING and NEWCOMBE.

Course 15 constitutes a *journal club* in which important papers on botany are reviewed and discussed by the instructors and special students. Results of original work are also reported from time to time, and occasional papers are presented by botanists from other institutions.

SECOND SEMESTER.

Investigations in physiology and morphology, and the work in current literature of botany are continued from the 1st semester; or any of these subjects may begin in the 2d semester. For undergraduates, this work is designated in courses as

18. Investigations in Physiology. Professor NEWCOMBE.

20. Investigations in Morphology. Professor SPALDING.

22. Current Literature of Botany. *One hour.* Professors SPALDING and NEWCOMBE.

DEGREES.

The degree of Master of Science, or, at the choice of the candidate, Master of Arts, may be taken by a student who has received a bachelor's degree and has completed one year of required work at the University of Michigan. If botany is taken as a major, it is advantageous, though not obligatory, to pursue one of the minors in the same department. A thesis may or may not be included in the work for the degree.

The degree of Doctor of Science, or, by choice of the candidate, Doctor of Philosophy, is also open to all persons who have received a bachelor's degree, and who have a knowledge of French and German sufficient for purposes of research. As a rule, three years of graduate study will be necessary, the last two semesters of which must be spent at this University. If botany be chosen as a major subject, one of the minors may be in the same department; the other should be taken in chemistry, zoology, or some related science. A thesis showing capacity for original investigation and embodying results which are a recognized contribution to science is invariably required. The thesis must be printed in full or in part, as may be approved by the responsible committee, and one hundred and fifty copies must be deposited in the University library for exchange with other universities.

FEES AND EXPENSES.

Matriculation Fee.—Every student before entering any department of the University is required to pay a matriculation fee. This fee, which, for a citizen of Michigan, is ten dollars, and for a person who comes from any other State or country, twenty-five dollars, is paid but once, and entitles the student to the privileges of permanent membership in the University.

Annual Fee.—In addition to the matriculation fee, every student has to pay an annual fee for incidental expenses. This fee is paid the first year of residence at the University, and every year of residence thereafter. Resident graduates are required to pay the same annual fee as undergraduates. The annual fees are for Michigan students, thirty dollars; for all others, forty dollars.

Laboratory Expenses.—Students who pursue laboratory courses of study are required to pay for the materials and apparatus actually consumed by them. The deposits required in advance are different for the different courses, ranging from one to twenty dollars. The laboratory expenses of students will vary with their prudence and economy.

Diploma Fee.—The fee for the diploma given on graduation is ten dollars, and the by-laws of the Board of Regents prescribe that no person shall be recommended for a degree until he has paid all dues, including the fee for diploma.

Other Expenses.—Students obtain board and lodging in private families for from three to five dollars a week. Clubs are also formed in which the cost of board is from one dollar and a half to two dollars and a half per week. Room rent varies from seventy-five cents to two dollars a week for each student.

FERRY BOTANICAL FELLOWSHIP.

Through the liberality of Hon. D. M. Ferry of Detroit a Botanical Fellowship amounting to $500 is maintained at the University of Michigan. Candidates for this fellowship must be graduates of this or some other university who have given evidence of capacity for research, preferably by publication of results of investigation, though this is not an absolute requirement. The present holder of the Fellowship is Mr. Joseph W. T. Duvel, whose work on conditions affecting the germination of seeds has been accepted for publication by the U. S. Department of Agriculture.

FORESTRY.

The recent awakening to an interest in forestry has created a demand for men who shall assume the control of forests and lands, and make them more productive and their production more permanent.

While at the present time the demand for such men is mainly from the departments of the United States government having in charge the work of caring for the forest reservations in the public domain, and of conducting investigations upon the actual timber resources of the country, the great attention which is being given to forestry problems by state governments and by individuals indicates that very soon there will arise a call from these sources for men well trained in forestry science and practice.

These considerations and the needs of our own state for well-trained investigators and directors of experimental and practical forestry work, led to the establishment of a Department of Forestry in the University of Michigan and to making provision for begining instruction in that subject, by the Board of Regents in June, 1901.

For the present, for purposes of facilitating administration, the work in Forestry is intimately associated with that in Botany in the Department of Literature, Science, and the Arts, but unlike most of the work in Botany, all of the courses in Forestry, except Course I, are of a purely technical nature, and are planned with a view of fitting students taking them, for entrance upon the profession of Forestry as a means of livelihood. Because of this, and since maturity of mind, and a considerable knowledge of a number of basal sciences are essential to successful prosecution and mastery of the work, the technical courses in Forestry are regularly open only to students who have already received a bachelor's degree from this University or from some college or university giving the bachelor's degree for an equivalent amount of work. Moreover, the character and sequence of the undergraduate work is regarded as of so much importance that prospective forestry students are advised to consult the instructor in Forestry for advice and direction, as early as possible in their undergraduate course, in order to insure the proper preparation for technical work. These undergraduate courses (see University Calendar, 1901-2) should cover the following subjects:—

Mathematics: Courses 1 and 2, or 1*a*, 2*a*, 3*a* and 4*a*.
Physics: Courses 1 and 2.
General Chemistry: Courses 1 and 2.
Organic Chemistry: Course 28.
Analytical Chemistry: Course 3.
English: Courses 1 and 2.
German: At least eight hours.
French: Four or 8 hours.
General Biology: Courses 1 and 2.
Zoölogy: Courses 2 and 8.
Botany: Courses 3, 9, 10 and 12.
History: Courses 1, 2, 3 and 4.
Political Economy: Courses 2 and 3.
Geology: Courses 1, 2, 6 and 7.

EQUIPMENT.

The location of the University of Michigan is most favorable, in many respects, for the practical study of Forestry. Ann Arbor is situated in a region formerly heavily wooded with broad-leaved timber trees, and there are, in the immediate vicinity, many easily accessible tracts of the forests typical of the region. Large areas of sprout—and young seedling—forest are also to be found near by, while within a few hours' ride lie the remnants of the great pineries for which Michigan has been famous, and thousands of acres of stump land, both of pine and hard-wood forests, with the interesting silvicultural problems which they present, are even nearer by. The state within its borders also furnishes numerous examples of various types of lumbering operations, from those supplying only small portable saw mills to the large establishments cutting millions of feet each year, and recently more than ten thousand acres of land in the eastern part of the state have been donated to the University for the purpose of forest experiment.

Because of its close connection with the work of the Department of Literature, Science, and the Arts, the facilities of the University in Botany, Zoölogy, Geology, Chemistry and Mineralogy and the extensive museum collections and libraries illustrating these subjects are available for use by students in Forestry. The library of the University is supplied with current forestry periodicals and a considerable number of standard works upon the important phases of Forestry, which number will be constantly increased. A collection of woods, material for illustrating diseases of trees and timber, lantern slides and other essential equipment for the work of instruction in the subjects embraced in Forestry are either at hand or in process of accumulation for use during the ensuing year.

The courses in Forestry, as planned, will cover two full years of work, the year being divided into semesters. The work of the first year is arranged with a view of allowing a certain amount of latitude in supplementary courses, in order that deficiencies may be made up, where this is necessary. In all courses, actual illustrations in the field will be used whenever practicable, and a considerable portion of the last half of the second year's work will be devoted to the study of forest conditions and problems, methods of utilization, and other important matters, at various points away from Ann Arbor. During this year, it is also planned to have a series of lectures upon forest utilization and exploitation by prominent lumber men, and other operators, familiar with the commercial side of the subject.

Only the following courses will be given in the year 1902-'03, and these constitute the technical work in Forestry of the first year. They are to be supplemented by sufficient work in collateral lines to make a full year's work, and are to be followed by the work of the second year, which will, when established, continue with the higher technical phases of Forestry proper, including courses in Forest Management, Forest Protection, Forest History, etc.

DESCRIPTION OF COURSES OF INSTRUCTION.

Introduction to Forestry: Mr. C. A. Davis. A general presentation of the importance and aims of Forestry and its relationship to state and national life and growth; the scope of the subject and the need for the practice of Forestry in the United States. Open to undergraduates and graduates. Lectures, *three hours, first semester.*

Schlich: Manual of Forestry. Brown and Nisbet: The Forester. Bruncken: N. A. Forests and Forestry. Fischback: Lehrbuch der Forstwissenschaft. Cotta: Grundriss der Forstwissenschaft.

Silviculture: Mr. C. A. Davis. A statement and discussion of the laws controlling the distribution, the development and growth of trees and of forests, and their application in methods of improving, caring for and reproducing forest crops. Incidentally the selection and care of trees used for ornamental purposes and for shade in streets and in private and public grounds and parks will be considered. Lectures, laboratory and field work. *Four hours, second semester.* (Open only to graduates.)

Schlich: Manual of Forestry. Brown and Nisbet: The Forester. Green: Forestry in Minnesota. Grigor: Arboriculture. Cotta: Anweisung zum Waldbau. Hartig: Lehrbuch für Förster. Weise: Leitfaden für den Waldbau.

Dendrology: Mr. C. A. Davis. The study of trees and shrubs, their structure, development, relationships, names, distribution, and actual and possible uses. Lectures, laboratory and field work. *Three hours, first semester.* (Open only to graduates.)

Sargent: Silva of North America. W. Stevenson: Trees of Commerce. Matthews: Familiar Trees and their Appearance. Pinchot: The White Pine. Emerson: Trees and Shrubs of Massachusetts. Sargent: Woods of the United States.

Dendrology: Mr. C. A. DAVIS. A continuation of Course 3 in which the biological side of the subject will be especially considered. Lectures, laboratory and field work, *Three hours, second semester.* (Open only to graduates.) Koch: Dendrologie. F. Schwartz: Forstliche Botanik.

Forest Mensuration: Mr. C. A. DAVIS. The methods of finding the volume of felled and standing trees and of whole forests, and the discussion of the principles underlying these. Methods of determining the rate of increase in height, diameter, and volume of individual trees, and of stands, and of estimating timber. Lectures, recitations and practical work. *Three hours, first semester.* (Open only to graduates.)

Müller: Lehrbuch der Holzmesskunde. Schlich: Manual of Forestry.

Forest Mensuration: Mr. C. A. DAVIS. A continuation of Course 5. During the spring term a large part of the time devoted to this course will be spent in the woods in practically applying the principles already learned in work upon a large scale. *Three hours, second semester.* (Open only to graduates.)

Information with regard to other courses to be pursued during this year may be found in a special circular relating to the work in Forestry.

CONTRIBUTIONS FROM THE BOTANICAL LABORATORY OF THE UNIVERSITY OF MICHIGAN,

1898-1902.

35. Comparative Structure of the Leaves of Datura Stramonium, Atropa Belladonna and Hyoscyamus Niger. Julius O. Schlotterbeck and Abraham Van Zwaluwenburg. Pharmaceutical Archives, I, 1898, 1.
36. A Study of Stramonium. Julius O. Schlotterbeck and Abraham Van Zwaluwenburg. The Pharmacologist, I, 1898, 65.
37. Histology of Clove Bark. Abraham Van Zwaluwenburg. The Pharmacologist, I, 1898, 97.
38. The Developmental History of Important Seeds. Abraham Van Zwaluwenburg, Pharmaceutical Archives, II, 1898, 11.
39. Cellulose-Enzyme. Frederick C. Newcombe. (Vorl. Mittheilung) Bot. Centralblatt, LXXIII, 1898, 105.
40. The White Pine (Pinus Strobus). Volney M. Spalding. U. S. Dept. Agri., Div. of Bot., Bull. No. 22, 1899, 11.
41. Cellulose Enzymes. Frederick C. Newcombe. Annals of Botany, XIII, 1899, 49.
42. Pseudo-Pleurococcus, nov. gen. Julia W. Snow. Annals of Botany, XIII, 1899, 189.
43. Ulvella Americana. Julia W. Snow. Bot. Gazette, XXVII, 1899, 309.
44. The Mechanism of Root Curvature. James B. Pollock. Bot. Gazette, XXIX, 1900, 1.
45. The Development and Function of the Cell-Plate in Higher Plants. Hamilton G. Timberlake. Bot. Gazette, XXX, 1900, 73.
46. Notes on the Mechanics of the Seed-Burying Awns of Stipa avenacea. Lewis Murbach. Bot. Gazette, XXX, 1900, 113.
47. Progress in Forestry Under State Control. Volney M. Spalding. Science, 1900.
48. A Contribution to the Natural History of Marl. Charles A. Davis. Journal of Geology, VIII, 1900.
49. Progress of Forest Management in the Adirondacks. Volney M. Spalding. Science, 1901.
50. Transition from Stem to Root in Echinocystis lobata Torr. and Gray. James B. Pollock. Third Report Mich. Acad. Sci., 1901, 40.
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UNIVERSITY BULLETIN.
New Series, Vol. IV. No. 16.

Walter Mulford

UNIVERSITY OF MICHIGAN

DEPARTMENT OF LITERATURE, SCIENCE, AND THE ARTS

ANNOUNCEMENT
OF THE WORK IN
FORESTRY
1903-1904

ANN ARBOR, MICHIGAN
PUBLISHED BY THE UNIVERSITY
1903

COURSES IN FORESTRY

The Courses in Forestry are given in the Department of Literature, Science, and the Arts.

OFFICERS OF ADMINISTRATION AND INSTRUCTION

FILIBERT ROTH, B.S., *Professor of Forestry.*
CHARLES A. DAVIS, A.M., *Instructor in Forestry.*

ALBERT BENJAMIN PRESCOTT, M.D., LL.D., *Professor of Organic Chemistry.*
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FREDERICK CHARLES NEWCOMBE, PH.D., *Junior Professor of Botany.*

OBJECTS.

In establishing Courses in Forestry in the University of Michigan, in June, 1901, the principal aims of the University were as follows:

To promote Forestry in the State of Michigan.
To assist in the proper care of State Forest lands.
To care for the University Forest Reserves.
To train young men to forestry work.

To promote forestry, or the right use and improvement of our woods and woodlands, the University is expected to co-operate with the State Forest Commission in bringing the important subject of Forestry before the people of our State through publications and addresses, and also to assist owners of woodlands with advice and with personal direction on the ground.

At the present time the State of Michigan has over six million acres of lands which have reverted for non-payment of taxes. A small portion of these lands has already been set aside as forest reserves and the friends of forestry are urging the immediate increase of these reserves, the object being chiefly to provide suitable protection against fire and thus prevent those great calamities which usually have their origin on the large unproductive and unprotected "slash" or cut-over lands. Such a protection will afford the young growth, starting here and there, an opportunity to grow and will warrant the expenditure of some money in the actual improvement of these culled and cut-over lands. These reserves are under the management of the State Forest Commission, but the University, through its work in Forestry, will take an advisory, and, to some extent, supervisory position in the care of these lands.

Through the kindness, liberality, and far-sightedness of Hon. F. W. Fletcher, member of the Board of Regents, the University has a Forest Reserve of over 8,000 acres, which it is hoped will be increased as rapidly as possible. The care of these lands is one of the principal duties of the instructors in Forestry, and the aim to be attained is not only to set an example in the handling of such lands, but also to make them permanently and continuously useful to the University.

In the training of men in the work of caring for our woods and of improving the present conditions of our woods and woodlands, the general conditions of our country and the consequent needs of the men will form the principal guide in shaping the courses of study, as well as in their presentation.

OPPORTUNITIES AND FACILITIES.

By referring to the University Calendar for 1902-3, pp. 24-45, it will be seen that facilities for pursuing the fundamental and accessory studies of languages, mathematics, physics, chemistry, botany, zoology, etc., are amply provided for. Special facilities for teaching the courses in Forestry exist, and additional equipment, collections, etc., are being brought together at the present time.

For field work the vicinity of Ann Arbor offers the best of opportunities. Convenient rural street car systems take the student, at very moderate cost, to a variety of hardwood and swamp forests, where all conditions from the virgin woods to the slash are met with, and where a study of the results of good and bad work are well calculated to prepare the student for his future task. In addition, a few hours' ride by steam car suffices to reach the pineries of the Southern Peninsula, the home of the famous Michigan pine, where cut-over lands, dotted here and there with tracts of good pine, and occasionally by patches of second growth, present the many conditions of the great problem of reforestation and offer reliable hints for future management.

To introduce the student into the actual business of caring for such lands and their improvement, it is the intention to have him partake of the real work of caring for the State and University lands, and thus begin, under proper supervision, to practice what he has learned.

In addition, it is hoped to utilize students and graduates in assisting owners of woodlands, who apply to the University for advice or assistance, by preparing proper plans, and, if desired, by supervising the operations on these lands.

The absence of any well-regulated forests, similar to those of many European countries, might be regarded as a serious drawback in the educational facilities, since such woods represent the goal to be obtained. However, the student here prepares himself for a task quite different from that of managing a forest as a superior officer, with the woods, the market, the forest officers and laborers all completely and permanently organized and prepared. His duty will largely be that of caring for wild woods, for cut- and burned-over pinery lands, and the improvement of badly mismanaged woodlots, where everything is new, everything yet to be done, the forest to be made, the help to be organized and trained, the market to be sought and improved, and the people of the district to be convinced of the usefulness of the forest and the necessity of its proper protection. For these reasons it is believed that the field-work under the very conditions which he has to face in actual practice in forests where the wild woods conditions have existed for centuries, will prove fully as instructive as work under settled conditions, and perhaps even more useful.

THE COURSE IN FORESTRY.

Generally speaking, the Course in Forestry is a two-years course, open only to graduate students and to properly qualified special students.

Students who, on entering this University, plan to make forestry their profession, may, by adopting approximately the following programme of studies, enter on forestry work during their fourth, or senior, year; obtain a bachelor's degree at the end of that year; and then, by an additional year's work in Forestry, acquire the Master's Degree in Forestry.

List of fundamental and supplementary studies which should be completed by the candidates for the degree in Forestry:

French, Courses 1 and 2, *eight hours.*
German, Courses 1 and 2, *eight hours.*
English, Courses 1 and 2, *six hours.*
Rhetoric, Courses 1 and 2, *six hours.*
Political Economy, Courses 2 and 3, *seven hours.*
Mathematics, Courses 1 and 2, *eight hours.*
Physics, Courses 1 and 2, *eight hours.*
Chemistry, General, Courses 1 and 2, *eight hours.*
Chemistry, Analytical, Course 3, *seven hours.*
Mineralogy, Course 1 or 2, *two* or *five hours.*
Geology, Courses, 1, 2, and 7, *nine hours.*
Biology, General, Courses 1 and 2, *eight hours.*
Botany, Courses 3, 7, 9, 10, and 12, *fourteen hours.*
Zoology, Courses 4, 6. 8, and 16, *fourteen hours.*
Engineering Surveying, Courses 4 and 5, *five hours*
Engineering, Civil, Course 15, *two hours.*

Graduates seeking a degree and not having had an equivalent of the studies above outlined will be required to make up these deficiencies during their two years study of Forestry.

The general scope of the courses of study above enumerated is indicated, in brief, as follows:

French and German.—A study of the grammar with the reading of modern prose and practice in speaking and writing.

English.—An historical outline of English Literature, designed to give a general introduction to the subject.

Rhetoric.—Practical work in English composition, writing and criticizing of essays.

Political Economy.—Elementary treatment of such topics as Production, Exchange, Distribution, and the History of Industrial Society.

Mathematics.—Advanced Algebra, together with the Elements of Plane Trigonometry and Plane Analytic Geometry.

Physics.—A year of advanced study of the subjects of Mechanics, Sound, Light, Heat, and Electricity.

Chemistry.—After a year's work in general inorganic chemistry, requiring attendance upon lectures, rectiations, and laboratory exercises, the student enters upon a systematic course of qualitative analysis.

Mineralogy and Geology.—The instruction in these subjects is designed to acquaint the student with the most characteristic properties of common rocks and minerals, and with some of the most prominent features of the geological structure of the earth's crust.

General Biology.—A study of typical species of plants and animals with reference to structure, function, development, and relationship, designed as introductory to the more advanced work in botany and zoology.

Botany.—(a) General morphology and physiology of plants, cell-structure, tissue-structure, and instruction in laboratory technique. (b) Experimental morphology and physiology, evolution of form and habit in adaptation to environment, and a study of the relation of plants to their environment as manifested by the phenomena of nutrition, growth, and irritability. (c) An introduction to the study of Forest Botany.

Zoology.—(a) Structure, classification, distribution, and life-history of invertebrate animals, with special reference to the principles of organic evolution. (b) Classification, habits, distribution, and comparative anatomy of vertebrates. (c) Systematic zoology, involving a study of local fauna, whereby students have an opportunity to become acquainted with the methods and aims of systematic work.

Surveying.—The use of instruments, and practice work in topography with aid of transit, stadia, plane, table, and camera.

Civil Engineering.—A special course on the choice and use of material in the construction of roads and highways.

SPECIAL WORK IN FORESTRY.

1. Introduction to Forestry. Lectures. *Two hours, first semester.* Professor Roth.

   A general presentation of the subject, its history, object, and methods, as well as economic importance. This course is intended chiefly for teachers and students of political economy. Open to all students above the second year.

2. Silviculture. Mr. C. A. Davis.

   This course is given as follows:

   2a. Silviculture. Introductory, including the study of soil, climate and other conditions (site) and their influence on forest growth. *Three hours, first semester.*

   2b. Silviculture. Methods of artificial and natural reproduction; seedbed and nursery work; planting and sowing in forest; reforestation of denuded lands, prairies, dunes, etc. *Three hours, second semester.*

   2c. Silviculture. Care of forest; cleaning and thinning; protection of forests against insects and other enemies. *Three hours, first semester.*

Courses *2a*, *2b*, and *2c* should be taken in the order here given. They are open only to students of forestry in their first and second years.

3. Forest Mensuration and Description. Lectures, laboratory work, and field work. *Three hours through the year.* Professor Roth.

Methods of measuring the volume of the individual tree and entire bodies or stands of timber; timber estimating; measurement of the rate of growth of trees and stands; methods and manner of describing a tract of forest to secure its proper management.

Open only to students of forestry in first year.

4. Forest Utilization. Lectures. *Three hours, first semester.* Professor Roth.

Use of timber; points of production and market; methods of lumbering, milling, and marketing; minor forest industries.

Open only to forestry students in their second year.

5. Forest Management. Lectures and field work. *Two hours, first semester,* and *eight hours, second semester.* Professor Roth.

General forest survey and preparation of working plans; administration and regulation of the field and office work in the care of a large tract of timber and the methods of calculation involved in judging the value of forests and forest operations.

Open only to forestry students in second year.

6. Dendrology. Lectures, laboratory work and field work. *Three hours, second semester.* Mr. C. A. Davis.

Monographic study of forest trees; their life history, distribution, requirements, behavior and possibilities in the forest.

Open only to forestry students in first year.

7. Timber Physics. Lectures and laboratory work. *Three hours, first semester.* Mr. C. A. Davis.

Study of structure, distinctive characteristics and technical properties of our common woods, and the relation of these properties to the principal uses of timber.

Open to Forestry and to engineering students. Regular forestry students are expected to take this course in their second year.

REQUIREMENTS FOR ADMISSION.

Candidates for a Master's Degree in Forestry must be not less than twenty years of age and must produce certificates of good moral character. In addition, they must conform to the following requirements of the Graduate School of the University:

All applicants for admission to Graduate work in Forestry must first report to the Dean of the Department of Literature, Science, and the Arts, and present their credentials. They will then be referred to the Secretary of the Administrative Council of the Graduate School for the arrangement of courses of study.

The privileges of the Graduate School are open to graduates of the Department of Literature, Science, and the Arts of this University, and to graduates of other universities and colleges, who satisfy the Administrative Council that they are qualified to pursue with profit the advanced courses of study offered in the school.

Graduates of institutions where the undergraduate courses of study are not substantially equivalent to the course prescribed at this University, if admitted to the school, are ordinarily required to do an additional amount of undergraduate work, or to prolong their term of residence as candidates for a higher degree.

Graduates of this University, or of other institutions, who do not wish to become candidates for a degree, may be admitted and registered as special resident graduates.

Graduates of other institutions who are candidates for a bachelor's degree in the Department of Literature, Science, and the Arts, are not registered in the Graduate School.

FEES AND EXPENSES.

Matriculation Fee.—Every student before entering any department of the University is required to pay a matriculation fee. This fee, which, for a citizen of Michigan, is ten dollars, and for a person who comes from any other State or country, twenty-five dollars, is paid but once, and entitles the student to the privileges of permanent membership in the University.

Annual Fee.—In addition to the matriculation fee, every student has to pay an annual fee for incidental expenses. This fee is paid the first year of residence at the University, and every year of residence thereafter. Resident graduates are required to pay the same annual fee as undergraduates. The annual fee in the Department of Literature, Science, and the Arts is, for Michigan students, thirty dollars; for all others, forty dollars.

Laboratory Expenses.—Students who pursue laboratory courses of study are required to pay for the materials and apparatus actually consumed by them. The deposits required in advance are different for the different courses, ranging from one to twenty dollars. The laboratory expenses of students will vary with their prudence and economy.

Diploma Fee.—The fee for the diploma given on graduation is ten dollars, and the by-laws of the Board of Regents prescribe that no person shall be recommended for a degree until he has paid all dues, including the fee for diploma.

Other Expenses.—Students obtain board and lodging in private families for from three to five dollars a week. Clubs are also formed in which the cost of board is from one dollar and a half to two dollars and a half per week. Room rent varies from seventy-five cents to two dollars a week for each student.

DEGREE.

On completion of the course in Forestry as above outlined, the student is entitled to the degree of Master of Science in Forestry.

THE UNIVERSITY YEAR.

The University Year is divided into two semesters, which, for the year 1903-1904 are arranged as follows: First Semester, from Sept. 29, 1903, to Feb. 12, 1904; second semester, from Feb. 15, 1904, to June 22, 1904.

Examinations for admission to the Department of Literature, Science, and the Arts are held Sept. 23-26, 1903, and Feb. 12-13, 1904.

OPENING FOR FORESTERS.

The question will naturally be asked: "What are my chances for work if I take the course in Forestry?" The answer to this is not as easy as with regard to some other courses, for the reason that forestry, the right use and care of woods, in our country is in its infancy,—it is just beginning.

Generally speaking, we may say that the woodlands of our country cover several hundred million acres; that the greater part is culled, cut and burned over; that even today about eighty million people, with a most extraordinary and constantly increasing consumption of wood, depend upon a judicious use of what there is left of the old forests on these woodlands, and that the most diligent care of the woods will be necessary to guard against a serious disturbance in our economic relations, which probably can not be avoided entirely.

It will require the trained heads and hands of several thousand good men to start the work of improving our woods, and it will require the continuous effort for all time of many thousands more to continue the work most successfully.

Fortunately it may be said that a general awakening to the needs of better treatment of woodlands has taken place. All classes of people are beginning to realize two simple but important truths:

That not all the land in any state can be used for ploughland, and

That it is wasteful to leave the large areas (in the aggregate) of non-agricultural lands in a non-productive waste-land condition.

As a consequence of this awakening, guided and promoted especially by the intelligent and energetic efforts of the United States Department of Agriculture in its Bureau of Forestry, hundreds of owners of woodlands have of late called for the advice and assistance of men trained in the right use and care of woods. That this demand for help will increase is certain, and it is reasonable even to believe that quite a rapid increase of this demand may be looked for. As it is, there are hundreds of estates now in charge of untrained men, who are unable to provide more than mere patrol service, while the service of a trained man would not cost any more and would certainly yield larger returns.

Besides the owners of estates whose lands are held for various reasons, there are numerous parties engaged in dealing in timber lands for purposes of direct exploitation (lumbering) or for speculation, who employ well-paid men as "timber-lookers," "estimators" or "cruisers," to perform the work of timber or forest survey, usually with a view to determine the present market value of the woods. That a trained man who sees not only the merchantable stem but also appreciates and is able to report intelligently all features which make up the forest and its wealth, would be more useful than the untrained man, would seem to require no argument. The trained timber surveyor, then, should replace the untrained "timber-looker."

Besides the positions in private life, there are, even now, many positions in the National and State Reserves open to properly qualified foresters.

As soon as the present policy of getting rid of all poor lands is changed into the proper policy of accumulating forest lands, there will be in a number of our states, and notably in Michigan, a demand for trained men to assume charge of these lands, to protect and improve them. So far the National Government has over sixty-one million acres of forest reserves, and may be expected to have over one hundred million acres before long. The State of New York has bought over a million acres, and the State of Pennsylvania has over one-half million acres, though the proper policy of accumulating the non-agricultural lands has but begun in that State. Similarly, the State of Wisconsin has set aside all State lands, of whatever kind, as a forest reserve, to be held and managed as a continuous benefit to the people.

Looking back only fifteen years, the progress in forestry interest and actual forestry effort is such that it is reasonable to suppose that the good work has just begun, and will now continue with more and more speed and success.

Comparing the forester's place to positions in other callings, it may be said that the chances for a life of usefulness, activity, health and contentment are given, but that the opportunity of rising to great prominence and wealth will rarely exist. The forester is and always will be a woods man rather than a man of the busy world, where the affairs of men daily make and unmake fortunes.

The University Bulletin is issued by the University of Michigan every six weeks during the University year. Entered as Second-class Matter at the Post Office at Ann Arbor, Michigan.

UNIVERSITY OF MICHIGAN

Walter Mulford

UNIVERSITY BULLETIN

NEW SERIES, VOL. V, NO. 16, AUGUST, 1904

Department of Literature, Science, and the Arts

ANNOUNCEMENT OF WORK IN

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ANN ARBOR PLANT
The Richmond & Backus Co.
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HARRY BURNS HUTCHINS, LL.D., *Professor of Law and Dean of the Department of Law.*
JAMES HENRY BREWSTER, Ph.B., LL.B., *Professor of Conveyancing.* 902 Baldwin Avenue.
HORACE LAFAYETTE WILGUS, M.S., *Professor of Law.*
ROBERT EMMET BUNKER, A.M., LL.B., *Professor of Law.*
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MOSES GOMBERG, Sc.D., *Junior Professor of Organic Chemistry.* 1101 East University Avenue.
FREDERICK CHARLES NEWCOMBE, Ph.D., *Junior Professor of Botany.*
EDWARD DAVID JONES, Ph.D., *Assistant Professor of Commerce and Industry.*
ALFRED C. LANE, Ph.D., *State Geologist Lecturer on Economic Geology.*

OBJECTS

In establishing Courses in Forestry in the University of Michigan, in June, 1901, the principal aims of the University were as follows:

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To assist in the proper care of State Forest lands.
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To promote forestry, or the right use and improvement of our woods and woodlands, the University is expected to co-operate with the State Forest Commission in bringing the important subject of Forestry before the people of our State through publication and addresses, and also to assist owners of woodlands with advice and with personal direction on the ground.

At the present time the State of Michigan has over six million acres of lands which have reverted for non-payment of taxes. A small portion of these lands has already been set aside as *forest reserves,* and the friends of forestry are urging the immediate increase of these reserves and the establishment of a permanent State forest. Though but one year in operation, the work of the forest reserves is well under way. A "forester" and two regular "forest rangers" watch over the interests of the State and furnish to these wild lands the much needed protection against fire and other injury. In addition, some improvements have been undertaken. Under the direction of the professor of forestry, who acts as "Warden" to these reserves, over 50,000 young trees were planted this spring (1904) on the denuded "slash" lands, and a nursery has been established in which millions of young trees are to be raised. The policy of the State as developed so far is to do two principal things.

To give protection to these lands against fire and other injury and thus enable whatever young growth exists, to grow into useful material.

To improve the lands by actually restocking them with tree growth, to re-establish a forest where fires have left a blackened waste and have made a natural restocking impossible for a long time to come.

The wisdom of this action has commended itself strongly to the people all over the state, and even in the districts where the reserves are located, the state's policy is meeting with hearty co-operation, so that the continuance of this policy appears assured.

In the training of men in the work of caring for our woods and of improving the present conditions of our woods and woodlands, the general conditions of our country and the consequent needs of the men will form the principal guide in shaping the courses of study, as well as in their presentation.

OPPORTUNITIES AND FACILITIES

By referring to the University Calendar for 1903-4 it will be seen that facilities for pursuing the fundamental and accessory studies of languages, mathematics, physics, chemistry, botany, zoölogy, etc., are amply provided for.

For field work the vicinity of Ann Arbor offers the best of opportunities. Convenient rural street car systems take the student, at very moderate cost, to a variety of hardwood and swamp forests, where all conditions from the virgin woods to the slash are met with, and where a study of the results of good and bad work are well calculated to prepare the student for his future task. In addition, a few hours' ride by steam car suffices to reach the pineries of the Southern Peninsula, the home of the famous Michigan pine, where cut-over lands, dotted here and there with tracts of good pine, and occasionally by patches of second growth, present the many conditions of the great problem of reforestation and offer reliable hints for future management.

To introduce the student into the actual business of caring for such lands and their improvement, it is the intention to have him partake of the real work of caring for the State and University lands, and thus begin, under proper supervision, to practice what he has learned.

In the forestry laboratory students receive instruction in forest botany, timber physics, structure of woods, and certain features of wood technology, as well as in forest measurement and the methods of study of the growth of timber. A good collection of wood specimens, sections of trees, and herbarium material is provided and will be increased as rapidly as possible. There is an ample supply of microscopes, compasses, calipers, height measures, and other apparatus for use in the laboratory and in the field.

Through the kindness especially of the Lufkin Rule Company of Saginaw; E. C. Atkins & Co., manufacturers of the famous Atkins saws; the Champion Tool & Handle Works of Evart, Mich., and others, a very ample and select set of woodsman's tools have been added to the equipment of the school.

A large album, presented by President J. D. Hawks of the D. & M. Ry., and containing probably the most complete set of photographic views of Michigan lumbering, forms one of the most valuable additions to the forestry library. This latter, already of much value as a school library, is steadily growing, a regular department fund having been allowed for its increase.

Certain special facilities for the study of forestry are supplied by the Saginaw Forest Farm, a tract of land about one mile west of the city of Ann Arbor, presented to the University by Hon. Arthur Hill, of Saginaw The farm comprises eighty acres, and is a typical example of the low hilly land of the drift district, and contains as great a variety of topographical and soil conditions as could be expected in an area of this extent. Its soils vary from heavy clay to sandy gravel, and, in addition to its other good features, has a lake of clear water, from ten to fifty feet deep and covering an area of twelve acres.

The farm is to serve as an object lesson in forestry. Upon it provision is to be made for (1) an arboretum of all useful forest trees that can grow in Michigan; (2) demonstration areas for seed-bed and nursery work; (3) model plantations of forest trees, and (4) special experiments in forestry, relating to various methods of propagating different kinds of timber, to the raising of particular forest products, and to other practical purposes.

The absence of any well-regulated forests, similar to those of many European countries, might be regarded as a serious drawback in the educational facilities, since such woods represent the goal to be attained. However, the student here prepares himself for a task quite different from that of managing a forest as a superior officer, with the woods, the market, the forest officers and laborers all completely and permanently organized and prepared. His duty will largely be that of caring for wild woods, for cut- and burned-over pinery lands, and the improvement of badly mismanaged woodlots, where everything is new, everything yet to be done, the forest to be made, the help to be organized and trained, the market to be sought and improved, and the people of the district to be convinced of the usefulness of the forest and the necessity of its proper protection. For these reasons it is believed that the field-work under the very conditions which he has to face in actual practice in forests where the wild wood conditions have existed for centuries, will prove fully as instructive as work under settled conditions, and perhaps even more useful.

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Generally speaking, the Course in Forestry is a two-years course, open only to graduate students and to properly qualified special students.

Students who, on entering this University, plan to make forestry their profession, are expected to adopt approximately the following programme of studies, take course *one* in forestry during their junior year, and enter on forestry work during their fourth, or senior, year. By doing so they may obtain a bachelor's degree at the end of that year; and then, by an additional year's work in forestry, acquire the Master's Degree in Forestry.

In addition to the special work in forestry and allied subjects, the following fundamental and supplementary studies should be completed hy the candidates for the degree in forestry;

French, Courses 1 and 2, *eight hours.*
English, Rhetoric, Courses 1 and 2, *six hours.*
Political Economy, Courses 2 and 29, *seven hours.*
Mathematics, Courses 1 and 2, *eight hours.*
Physics, Courses 1 and 2, *eight hours.*
Chemistry, General, Courses 1 and 2, *eight hours.*
Mineralogy, Course 1, *two hours.*
Geology, Courses 1 and 7, *six hours.*
Biology, General, Courses 1 and 2, *eight hours.*
Botany, Course 7, *five hours.*
Zoology, Courses 4 and 8, *nine hours.*

Graduates seeking a degree and not having had an equivalent of the studies above outlined will be required to make up these deficiencies during their two years study of forestry.

The general scope of the courses of study above enumerated is indicated, in brief, as follows:

French and German.—A study of the grammar with the reading of modern prose and practice in speaking and writing.

English.—An historical outline of English Literature, designed to give a general introduction to the subject.

Rhetoric.—Practical work in English composition, writing and criticizing of essays.

Political Economy.—Elementary treatment of such topics as Production, Exchange, Distribution, and the History of Industrial Society.

Mathematics.—Advanced Algebra, together with the Elements of Plane Trigonometry and Plane Analytic Geometry.

Physics.—A year of advanced study of the subjects of Mechanics, Sound, Light, Heat, and Electricity.

Chemistry.—After a year's work in general inorganic chemistry, requiring attendance upon lectures, recitations, and laboratory exercises, the student enters upon a systematic course of qualitative analysis.

Mineralogy and Geology.—The instruction in these subjects is designed to acquaint the student with the most characteristic properties of common rocks and minerals, and with some of the most prominent features of the geological structure of the earth's crust.

General Biology.—A study of typical species of plants and animals with reference to structure, function, development, and relationship, designed as introductory to the more advanced work in botany and zoology.

Botany.—General morphology and physiology, involving a study of the structure of the cell and tissue, of organography, cell-theory, mitosis, heredity as well as of laboratory technique.

Zoology (*a*) Invertebrate Zoology. The structure, classification, distribution, and activities of invertebrate animals.

The laboratory work consists in (1) the dissection of one or more type-forms of each of the groups studied; (2) a study when possible of the instincts of one or more members of each group. The laboratory work is supplemented by occasional field excursions for the study of animals in their natural habitats, and for collecting.

(*b*) Vertebrate Zoology. The structure, classification, distribution, and habits of vertebrate animals. Lectures with practical work in field and laboratory. The field work will be definitely planned and regularly carried out, and will include observations of the habits of the native fishes, amphibia, reptiles, birds, and mammals, and the collection of specimens to be kept living or to be preserved.

SPECIAL WORK IN FORESTRY

1. Introduction to Forestry. Lectures. *Three hours, first semester.* Professor ROTH.

   A general presentation of the subject, its history, object, and methods, as well as economic importance. This course is intended chiefly for teachers and students of political economy. Open to all students above the second year.

2. Silviculture. Mr. C. A. DAVIS.

   This course is given as follows:

   2a. Silviculture. Introductory, including the study of soil, climate and other conditions (site) and their influence on forest growth. *Three hours, first semester.*

   2b. Silviculture. Methods of artificial and natural reproduction; seedbed and nursery work; planting and sowing in forest; reforestation of denuded lands, prairies, dunes, etc. *Three hours, second semester.*

2*c*. Silviculture. Care of forest; cleaning and thinning; protection of forests against insects and other enemies. *Three hours, first semester.*

Courses 2*a*, 2*b*, and 2*c* should be taken in the order here given. They are open only to students of forestry in their first and second years.

3. Forest Mensuration and Description. Lectures, laboratory work, and field work. *Four hours, first semester.* Professor ROTH.

Methods of measuring the volume of the individual tree and entire bodies or stands of timber; timber estimating; measurement of the rate of growth of trees and stands; methods and manner of describing a tract of forest to secure its proper management.

Open only to students of forestry in first year.

4. Forest Utilization. Lectures. *Three hours, second semester.* Professor ROTH.

Use of timber; points of production and market; methods of lumbering, milling, and marketing; minor forest industries.

Open only to forestry students in their second year.

5. Forest Management. Lectures and field work. *Five hours, through the year.* Professor ROTH.

General forest survey and preparation of working plans; administration and regulation of the field and office work in the care of a large tract of timber and the methods of calculation involved in judging the value of forests and forest operations.

Open only to forestry students in second year.

6. Dendrology. Lectures, laboratory work and field work. *Three hours, second semester.* Mr. C. A. DAVIS,

Monographic study of forest trees; their life history, distribution, requirements, behavior and possibilities in the forest.

Open only to forestry students in first year.

7. Timber Physics. Lectures and laboratory work. *Three hours, first semester.* Mr. C. A. DAVIS.

Study of structure, distinctive characteristics and technical properties of our common woods, and the relation of these properties to the principal uses of timber.

Open to Forestry and to engineering students. Regular forestry students are expected to take this course in their second year.

8. *Seminary.*—Hours to be arranged, no credit allowed. Reports on special topics are intended to familiarize the student with the topics themselves, sources of information and methods of presentation. This course is open only to candidates of the degree in forestry in their last year. Professor ROTH.

SPECIAL WORK IN ALLIED SUBJECTS

ENGINEERING

1 hr.

Surveying, Course 4. Use of Instruments. ~~Four~~ *hours, first semester.* Professor DAVIS and Mr. MERRICK.

Largely field work in which the student acquires the ability to use different surveying instruments with reasonable precision.

Topography, Course 5.—Transit and stadia, plane table and camera. Field work and drawing. *Four hours, second semester.* Professor DAVIS and Mr. MERRICK.

In this course the student learns to do regular survey work and map making.

Mechanical Engineering, Course —.—Boilers and steam engines. *Two hours, first or second semester.* Professor ALLEN.

Hydraulic Machinery, Course —.—Four sections. *Two hours.* Professors M. E. COOLEY and ALLEN, Assistant Professor F. M. DUNLAP, Mr. JACKSON, and Mr. BRAGG.

These courses in Mechanical Engineering are intended to acquaint the student with the principles and practice in the use of mechanical devices, such as are used in moving heavy and bulky materials, and have come into use so extensively in modern logging. Plans are forming for a course specially outlined to meet the requirements of forestry students and this course may be looked for in the year 1905-1906.

In addition to the above courses it is expected that special lectures will be delivered presenting expert knowledge of certain important phases of Forest Engineering.

BOTANY

first

9. Morphology and Classification of Fungi. This course deals with morphology, classification, life-history and economic relations of fungi. Students collect and identify material, and become acquainted with the most important literature on the subject. Forestry students elect this course as a four hour course and give special attention to the relation of fungi to forest growth. *Three or more hours; hours to be arranged.* Dr. POLLOCK.

2d sem

10. Experimental Physiology. A study of the relation of plants to their environment as manifested by the phenomena of nutrition, growth, and irritability. 10*a*, *three hours;* 10*b*, *five hours.* Lectures, *Tu, Th,* at 8. Room 12, U. H. Laboratory work, *mostly afternoons.* Professor NEWCOMBE.

12. Field Ecology. The identification of trees, shrubs, and herbaceous plants, and their grouping into societies; the relation of plants to light, soil, moisture, and the general factors in the environment. *Two hours.* Dr. BURNS.

4. Economic Botany. Relation of the science of botany to industry. Distribution of plants of commercial importance,

and laws determining plant distribution. Importation and acclimatization of foreign plants. Variation of raw materials and their improvement by breeding and selection. Origin and propagation of horticultural varieties. Bacteriology in its relation to industry. Important diseases of plants. Lectures, with accompanying demonstrations and lantern views. *M, W,* at 8. Museum Lecture Room. Dr. BURNS.

ZOOLOGY

7. The Fish and Fisheries of Michigan. This course treats of the fresh water fishes, their habits, commercial value, mode of capture and of propogation. Excursions will be made for collecting and to observe commercial fishing operations and propagation. The course is designed for forestry students, but is open to others without prerequisites. *One hour, to be arranged.* Professor REIGHARD.

LAW

a. Torts and Criminal Processes; together with State and Federal laws for the protection of forest property and for the promotion of forestry. *Two hours through the year.* Professors WILGUS, BUNKER and ROTH.

b. Law of Real Property; fixtures, easements, landlord and tenant, together with practice work in some phases of conveyancing. *Two hours, first semester.* Professors THOMPSON, BREWSTER, and Mr. STEIN.

c. Special Lectures in Law. For the year 1904-1905 students in forestry will attend the lectures on irrigation and mining law, by Judge CLAYBERG.

SURGERY

In this course the student learns a few of the simpler methods of surgery and medicine which are to enable the forester to give some help in emergency cases as they arise in camp life. The student also acquaints himself with such remedies and equipment as should be carried by every camping party when in the field for a considerable period. About eight lectures. *One hour per week, first half of first semester.* Professor NANCREDE, or Assistants.

REQUIREMENTS FOR ADMISSION

All applicants for admission to the Studies in Forestry should apply to the Dean of the Department of Literature, Science, and the Arts. This is true of special students as well as candidates for the degree.

Candidates for a Master's Degree in Forestry must be not less than twenty years of age and must produce certificates of good moral character. In addition, they must conform to the following requirements of the Graduate School of the University:

All applicants for admission to Graduate work in Forestry must first report to the Dean of the Department of Literature, Science, and the Arts, and present their credentials. They will then be referred to the Secretary of the Administrative Council of the Graduate School for the arrangement of courses of study.

The privileges of the Graduate School are open to graduates of the Department of Literature, Science, and the Arts of this University, and to graduates of other universities and colleges, who satisfy the Administrative Council that they are qualified to pursue with profit the advanced courses of study offered in the school.

Graduates of institutions where the undergraduate courses of study are not substantially equivalent to the course prescribed at this University, if admitted to the graduate school, are ordinarily required to do an additional amount of undergraduate work, or to prolong their term of residence as candidates for a higher degree.

Persons over twenty-one years of age who wish to pursue studies in this department, without becoming candidates for a degree, may be admitted as special students, provided they pass an examination in English, and show that they are qualified to pursue profitably the studies they may desire to take up. In the examination in English, applicants will be asked to write brief essays on subjects that will be assigned, and to answer questions on the rudiments of English grammar.

FEES AND EXPENSES

Matriculation Fee.—Every student before entering any department of the University is required to pay a matriculation fee. This fee, which, for a citizen of Michigan, is ten dollars, and for a person who comes from any other State or country, twenty-five dollars, is paid but once, and entitles the student to the privileges of permanent membership in the University.

Annual Fee.—In addition to the matriculation fee, every student has to pay an annual fee for incidental expenses. This fee is paid the first year of residence at the University, and every year of residence thereafter. Resident graduates are required to pay the same annual fee as undergraduates. The annual fee in the Department of Literature, Science, and the Arts, is, for Michigan students, thirty dollars; for all others, forty dollars.

Laboratory Expenses.—Students who pursue laboratory courses of study are required to pay for the materials and apparatus actually consumed by them. The deposits required in advance are different for the different courses, ranging from one to twenty dollars. The laboratory expenses of students will vary with their prudence and economy.

Diploma Fee.—The fee for the diploma given on graduation is ten dollars, and the by-laws of the Board of Regents prescribe that no person shall be recommended for a degree until he has paid all dues, including the fee for diploma.

Other Expenses.—Students obtain board and lodging in private families for from three to five dollars a week. Clubs are also formed in which the cost of board is from one dollar and a half to two dollars and a half per week. Room rent varies from seventy-five cents to two dollars a week for each student.

DEGREE

On completion of the course in Forestry as above outlined, the student is entitled to the degree of Master of Science in Forestry.

THE UNIVERSITY YEAR

The University Year is divided into two semesters, which, for the year 1904-1905 are arranged as follows: First Semester, from Sept. 27, 1904, to Feb. 5, 1905; second semester, from Feb. 13, 1905, to June 22, 1905.

Examinations for admission to the Department of Literature, Science, and the Arts are held Sept. 21, 1904, and Feb. 10-11, 1905.

OPENING FOR FORESTERS

The question will naturally be asked: "What are my chances for work if I take the course in Forestry?" The answer to this is not as easy as with regard to some other courses, for the reason that forestry, the right use and care of woods, in our country is in its infancy,—it is just beginning.

Generally speaking, we may say that the woodlands of our country cover several hundred million acres; that the greater part is culled, cut and burned over; that even today about eighty million people, with a most extraordinary and constantly increasing consumption of wood, depend upon a judicious use of what there is left of the old forests on these woodlands, and that the most diligent care of the woods will be necessary to guard against a serious disturbance in our economic relations, which probably can not be avoided entirely.

It will require the trained heads and hands of several thousand good men to start the work of improving our woods, and it will require the continuous effort for all time of many thousands more to continue the work most successfully.

Fortunately it may be said that a general awakening to the needs of better treatment of woodlands has taken place. All classes of people are beginning to realize two simple but important truths:

That not all the land in any state can be used for plough-land, and

That it is wasteful to leave the large areas (in the aggregate) of non-agricultural lands in a non-productive waste-land condition.

As a consequence of this awakening, guided and promoted especially by the intelligent and energetic efforts of the United States Department of Agriculture in its Bureau of Forestry, hundreds of owners of woodlands have of late called for the advice and assistance of men trained in the right use and care of woods. That this demand for help will increase is certain, and it is reasonable even to believe that quite a rapid increase of this demand may be looked for. As it is, there are hundreds of estates now in charge of untrained men, who are unable to provide more than mere patrol service, while the service of a trained man would not cost any more and would certainly yield larger returns.

Besides the owners of estates whose lands are held for various reasons, there are numerous parties engaged in dealing in timber lands for purposes of direct exploitation (lumbering) or for speculation, who employ well-paid men as "timber-lookers," "estimators" or "cruisers," to perform the work of timber or forest survey, usually with a view to determine the present market value of the woods. That a trained man who sees not only the merchantable stem but also appreciates and is able to report intelligently all features which make up the forest and its wealth, would be more useful than the untrained man, would seem to require no argument. The trained timber surveyor, then, should replace the untrained "timber-looker."

That this view is beginning to be held by our business men is best illustrated by the following letter recently received from the experienced president of one of the most extensive and successful business organizations in our State.

"It has been customary in our Mining Department to keep on our force young men, graduates of the Mining Schools, who commence in humble positions at small salaries, and if they show ability and character, are promoted from time to time, to positions of responsibility.

"I thought it might be wise to follow out the same thing in connection with our Land Department. Our company controls over a half million acres of forest land. We necessarily have more or less woodsmen constantly employed not only to estimate and look after trespassers and placing monuments, but we also have work for them in the office, keeping up the record, making maps, etc.

"Why is it not equally practicable and wise for young graduates from the forestry schools to enter into subordinate positions of this kind, in order that they may gradually grow up into positions of responsibility and management? Of course, to be a woodsman and timber estimator would require a lot of time and experience for the graduates of the forestry school, but they would get out into the woods with experienced men, and thus learn general woodcraft and estimating, and I would like to have two or three technically trained young men of this kind, of good general education, also of good character, who had been trained to estimate timber just as well as regular woodsmen, and who could be sent out to do it, or superintend doing it, at any time. Surveying, map making and keeping up the records, would also be in their regular line of work.

"We are doing considerable work also in the way of road making, and want to do more in that line, so as to improve the roads in our country, and also to see that the money expended for that purpose by the township officials, is spent in a better and more scientific manner than is generally the case.

"I would not want to bother with any young men, unless they are willing to commence at the bottom, and could be undoubtedly recommended for good character and industry. Do you think you have any such men that you could recommend to me? I should also be glad to have your own ideas or any suggestions that you may care to make, in this line of thought."

Besides the positions in private life, there are, even now, many positions in the National and State Reserves open to properly qualified foresters.

As soon as the present policy of getting rid of all poor lands is changed into the proper policy of accumulating forest lands, there will be in a number of our states, and notably in Michigan, a demand for trained men to assume charge of these lands, to protect and improve them. So far the National Government has over sity-one million acres of forest reserves, and may be expected to have over one hundred million acres before long. The State of New York has bought over a million acres, and the State of Pennsylvania has over one-half million acres, though the proper policy of accumulating the non-agricultural lands has but begun in that State. Similarly, the State of Wisconsin has set aside all State lands, of whatever kind, as a forest reserve, to be held and managed as a continuous benefit to the people.

Looking back only fifteen years, the progress in forestry interest, and actual forestry effort is such that it is reasonable to suppose that the good work has just begun, and will now continue with more and more speed and success.

Comparing the forester's place to positions in other callings, it may be said that the chances for a life of usefulness, activity, health and contentment are given, but that the opportunity of rising to great prominence and wealth will rarely exist. The forester is and always will be a woods man rather than a man of the busy world, where the affairs of men daily make and unmake fortunes.

Published by the University of Michigan every six weeks. Entered April 26, 1900, at Ann Arbor, Mich., as second-class matter under Act of Congress of July 16, 1894.

UNIVERSITY OF MICHIGAN

Walter Mulford

UNIVERSITY BULLETIN

NEW SERIES, VOL. VII, NO. 2, DECEMBER 15, 1905

DEPARTMENT OF LITERATURE, SCIENCE, AND THE ARTS

ANNOUNCEMENT OF WORK IN

FORESTRY

1905-1906

1837

ANN ARBOR
PUBLISHED BY THE UNIVERSITY
1905

GENERAL LIBRARY
PRINTING PLANT

COURSES IN FORESTRY

The Courses in Forestry are given in the Department of Literature, Science, and the Arts.

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EDWARD DAVID JONES, PH.D., *Assistant Professor of Commerce and Industry.*

ALFRED C. LANE, PH..D *State Geologist Lecturer on Economic Geology.*

OBJECTS

In establishing Courses in Forestry in the University of Michigan, in June, 1901, the principal aims of the University were as follows:

Objects.

To promote Forestry in the State of Michigan.
To assist in the proper care of State Forest lands.
To care for the University Forest Reserves.
To train young men to forestry work.

To promote forestry, or the right use and improvement of our woods and woodlands, the University is expected to co-operate with the State Forest Commission in bringing the important subject of Forestry before the people of our State through publication and addresses, and also to assist owners of woodlands with advice and with personal direction on the ground.

At the present time the State of Michigan has over six million acres of lands which have reverted for non-paymenf of taxes. A small portion of these lands has already been set aside as *forest rcserves*, and the friends of forestry are urging the immediate increase of these reserves and the establishment of a permanent State forest, Though but two years in operation, the work of the forest reserves is well under way. A "forester" and two regular "forest rangers" watch over the interests of the State and furnish to these wild lands the much needed protection against fire and other injury. In addition, some improvements have been undertaken. Under the direction of the professor of forestry, who acts as "Warden" to these reserves, over 130,000 young trees were planted the springs of 1904 and 1905 on the denuded "slash" lands, and a nursery has been established in which over two millions of young trees are growing today. The policy of the State as developed so far is to do two principal things:

To give protection to these lands against fire and other injury and thus enable whatever young growth exists, to grow into usefuf material.

To improve the lands by actually restocking them with tree growth, re-establish a forest where fires have left a blackened waste and have made a natural restocking impossible for a long time to come.

The wisdom of this action has commended itself strongly to the people all over the state, and even in the districts where the reserves are located, the state's policy is meeting with hearty co-operation, so that the continuance of this policy appears assured.

In the training of men in the work of caring for our woods and of improving the present conditions of our woods and woodlands, the general conditions of our country and the consequent needs of the men will form the principal guide in shaping the courses of study, as well as in their presentation.

OPPORTUNITIES AND FACILITIES

By referring to the University Calendar for 1904-5, it will be seen that facilities for pursuing the fundamental and accessory studies of languages, mathematics, physics, chemistry, botany, zoology, etc., are amply provided for.

For field work the vicinity of Ann Arbor offers the best of opportunities. Convenient rural street car systems take the student, at very moderate cost, to a variety of hardwood and swamp forests, where all conditions from the virgin woods to the slash are met with, and where a study of the results of good and bad work are well calculated to prepare the student for his future task. In addition, a few hours' ride by steam car suffices to reach the pineries of the Southern Peninsula, the home of the famous Michigan pine, where cut-over lands, dotted here and there with tracts of good pine, and occasionally by patches of second growth, present the many conditions of the great problem of reforestation and offer reliable hints for future management.

To introduce the student into the actual business of caring for such lands and their improvement, it is the intention to have him partake of the real work of caring for the State and University lands, and thus begin, under proper supervision, to practice what he has learned.

In the forestry laboratory students receive instruction in forest botany, timber physics, structure of woods, and certain features of wood technology, as well as in forest measurement and the methods of study of the growth of timber. A good collection of wood specimens, sections of trees, and herbarium material is provided and will be increased as rapidly as possible. There is an ample supply of microscopes, compasses, calipers, height measures, and other apparatus for use in the laboratory and in the field.

Through the kindness especially of the Lufkin Rule Company of Saginaw; E. C. Atkins & Co., manufacturers of the famous Atkins saws; the Champion Tool & Handle Works of Evart, Mich., and others, a very ample and select set of woodsman's tools have been added to the equipment of the school.

A large album, presented by President J. D. Hawks of the D. & M. Ry., and containing probably the most complete set of photographic views of Michigan lumbering, forms one of the most valuable additions to the forestry library. This latter, already of much value as a school library, is steadily growing, a regular department fund having been allowed for its increase.

Certain special facilities for the study of forestry are supplied by the Saginaw Forest Farm, a tract of land about one mile west of the city of Ann Arbor, presented to the University by Hon. Arthur Hill, of Saginaw. The farm comprises eighty acres, and is a typical example of the low hilly land of the drift district, and contains as great a variety of topographical and soil conditions as could be expected in in an area of this extent. Its soils vary from heavy clay to sandy gravel, and, in addition to its other good features, has a lake of clear water, from ten to fifty feet deep and covering an area of about twelve acres.

The farm is to serve as an object lesson in forestry. Upon it provision is to be made for (1) an arboretum of all useful forest trees that can grow in Michigan; (2) demonstration areas for seed-bed and nursery work; (3) model plantations of forest trees, and (4) special experiments in forestry, relating to the various methods of propogating different kinds of timber, to the raising of particular forest products, and to other practical purposes.

The absence of any well-regulated forests, similar to those of many European countries, might be regarded as a serious drawback in the educational facilities, since such woods represent the goal to be attained. However, here the student prepares himself for a task quite different from that of managing a forest as a superior officer, with the woods, the market, the forest officers and laborers all completely and permanently organized and prepared. His duty will largely be that of caring for wild woods, for cut- and burned-over pinery lands, and the improvement of badly mismanaged wood-lots, where everything is new, everything yet to be done, the forest to be made, the help to be organized and trained, the market to be sought and improved, and the people of the district to be convinced of the usefulness of the forest and the necessity of its proper protection. For these reasons it is believed that the field-work under the very conditions which he has to face in actual practice in forests where the wild wood conditions have existed for centuries, will prove fully as instructive as work under settled conditions, and perhaps even more useful.

THE COURSE IN FORESTRY

Generally speaking, the Course in Forestry is a two-years course, open only to graduate students and to properly qualified special students.

Students who, on entering this University, plan to make forestry their profession, are expected to adopt approximately the following programme of studies: take course *one* in forestry during their junior year, and enter on forestry work during their fourth, or senior year. By doing so they may obtain a bachelor's degree at the end of that year; and then, by an additional year's work in forestry, acquire the Master's Degree in Forestry.

In addition to the special work in forestry and allied subjects, the following fundamental and supplementary studies should be completed by the candidates for the degree in forestry:

German, Courses 1 and 2, *eight hours.*
French, Courses 1 and 2, *eight hours.*
English, Rhetoric, Courses 1 and 2, *six hours.*
Political Economy, Courses 2 and 29, *seven hours.*
Mathematics, Courses 1 and 2, *eight hours.*
Physics, Courses 1 and 2, *eight hours.*
Chemistry, General, Courses 1 and 2, *eight hours.*
Mineralogy, Course 1, *two hours.*
Geology, Courses 1 and 7, *six hours.*
Biology, General, Courses 1 and 2, *eight hours.*
Botany, Course 7, *five hours.*
Zoology, Courses 4 and 8, *nine hours.*

Graduates seeking a degree, and not having had an equivalent of the studies above outlined will be required to make up these deficiencies during their two years study of forestry.

The general scope of the courses of study above enumerated is indicated, in brief, as follows:

French and German.—A study of the grammar, with the reading of modern prose and practice in speaking and writing.

English.—An historical outline of English Literature, designed to give a general introduction to the subject.

Rhetoric.—Practical work in English composition, writing and criticizing essays.

Political Economy.—Elementary treatment of such topics as Production, Exchange, Distribution, and the History of Industrial Society.

Mathematics.—Advanced Algebra, together with the Elements of Plane Trigonometry and Analytic Geometry.

Physics.—A year of advanced study of the subjects of Mechanics, Sound, Light, Heat, and Electricity.

Chemistry.—After a year's work in general inorganic chemistry, requiring attendance upon lectures, recitations, and laboratory exercises, the student enters upon a systematic course of qualitative analysis.

Mineralogy and Geology.—The instruction in these subjects is designed to acquaint the student with the most characteristic properties of common rocks and minerals, and with some of the most prominent features of the geological structure of the earth's crust.

General Biology.—A study of typical species of plants and animals with reference to structure, function, development, and relationship, designed as introductory to the more advanced work in botany and zoology.

Botany.—General morphology and physiology, involving a study of the structure of the cell and tissue, of organography, cell-theory, mitosis, heredity as well as of laboratory technique.

Zoology (*a*) Invertebrate Zoology. The structure, classification, distribution, and activities of invertebrate animals.

The laboratory work consists (1) the dissection of one or more type-forms of each of the groups studied; (2) a study when possible of the instincts of one or more members of each group. The laboratory work is supplemented by occasional field excursions for the study of animals in their natural habitats, and for collecting.

(*b*) Vertebrate Zoology. The structure, classification distribution, and habits of vertebrate animals. Lectures with pratical work in field and laboratory. The field work will be definitely planned and regularly carried out, and will include observations of the habits of the native fishes, amphibia, reptiles, birds, and mammals, and the collection of specimens to be kept living or to be preserved.

SPECIAL WORK IN FORESTRY

1. Introduction to Forestry. Lectures. *Four hours, first semester* Professor Roth.

A general presentation of the subject, its history, object, and methods, as well as economic importance. This course is intended also for teachers and students of political economy. Open to all students above the second year, and taken by forestry students in their junior year.

2. Silviculture. Assistant Professor MULFORD.

This course is given as follows:

2*a*. Silviculture. Introductory, including the study of soil, climate and other conditions (site) and their influence on forest growth. *Three hours, first semester.*

2*b*. Silviculture. Methods of artificial and natural reproduction; seedbed and nursery work; planting and sowing in forest; reforestation of denuded lands, prairies, dunes, etc. *Three hours, second semester.*

2*c*. Silviculture. Care of forest; cleaning and thinning; protection of forests against insect and other enemies. *Three hours, first semester.*

Courses 2*a*, 2*b*, and 2*c* should be taken in order here given. They are open only to students of forestry in their first and second years.

3. Forest Mensuration and Description. Lectures, laboratory work, and field work. *Three hours, through the year.* Assistant Professor MULFORD.

Methods of measuring the volume of the individual tree and entire bodies or stands of timber; timber estimating; measurement of the rate of growth of trees and stands; methods and manner of describing a tract of forest to secure its proper management.

Open only to students of forestry in first year.

4. Forest Utilization. Lectures. *Four hours, second semester,* Professor ROTH.

Use of timber: points of production and market; methods of lumbering, milling, and marketing; minor forest industries.

Open only to forestry students in their second year.

5. Forest Management. Lectures and field work. *Five hours, through the year.* Professor ROTH.

General forest survey and preparation of working plans; administration and regulation of the field and office work in the care of a large tract of timber and the methods of calculations involved in judging the value of forests and forest operations.

Open only to forestry students in their last year.

6. Dendrology. Lectures, laboratory work and field work. *Three hours, second semester.* Assistant Professor MULFORD.

Monographic study of forest trees; their life history, distribution, requirements, behavior and possibilities in the forest.

7. Timber Physics. Lectures and Laboratory work. *Three hours.*

first semester. Assistant Professor MULFORD.

Study of structure, distinctive characteristics, and technical properties of our common woods, and the relation of these properties to the principle uses of timber.

8. *Seminary.*—Hours to be arranged, no credit allowed. Reports on special topics are intended to familiarize the student with the topics themselves, sources of information and methods of presentation. This course is open only to candidates for the degree in forestry in their last year. Professor ROTH and Assistant Professor MULFORD.

SPECIAL WORK IN ALLIED SUBJECTS

Candidates for the degree in forestry are required to take all of the work here outlined. Exceptions are made only by special permission.

ENGINEERING

Surveying, Course 4.—Use of Instruments. *One hour, first semester.* Professor DAVIS and Mr. MERRICK.

Largely field work in which the student acquires the ability to use different surveying instruments with reasonable precision.

Topography, Course 2.—Transit and stadia, plain table and camera. Field work and drawing. *Five hours, second semester.* Professor DAVIS and Mr. MERRICK.

In this course the student learns fo do regular survey work and map making.

Mechanical Engineering, Course 3.—Steam Engines. *Four hours, first or second semester.* Professor ALLEN.

This course in Mechanical Engineering is intended to acquaint the student with the principles and practice in the use of mechanical devices, such as are used in heavy or bulky materials, and have come into use so extensively in modern logging. Plans are forming for a course specially outlined to meet the requirements of forestry students.

In addition to the above courses it is expected that special lectures will be delivered, presenting expert knowledge of certain important phases of Forest Engineering.

BOTANY

9. Morphology and Classification of Fungi. This course deals with morphology, classification, life-history and economic relations of fungi. Students collect and identify material, and

become acquainted with the most important literature on the subject. Forestry students elect this course as a four hour course and give special attention to the relation of fungi to forest growth. *Three or more hours; hours to be arranged; first semester.* Dr. POLLOCK.

10. Experimental Physiology. A study of the relation of plants to their environment as manifested by the phenomena of nutrition, growth, irritability. 10*a*, *three hours;* 10*b*, *five hours.* Lectures, *Tu*, *Th*, at 8. Room 11, U. H. Laboratory work, *mostly afternoons. Second semester.* Professor NEWCOMBE.

13. Biological Relations of Plants. *Two hours, to be arranged.* By permission, students who are prepared to take up special problems may elect this course as *three or more hours. First semester.* Dr. BURNS.

Factors determining the distribution of plants, association of plants into societies, general distribution of forests, prairies and deserts. Lectures, accompanied by field studies of habits and adaptation, and laboratory work in ecological anatomy.

12. Field Ecology. The identification of trees, shrubs, and herbaceous plants, and their grouping into societies; the relation of plants to light, soil, moisture, and the general factors in the environment. *Two hours, second semester.* Dr. BURNS.

4. Economic Botany. Relation of the science of botany to industry. Distribution of plants of commercial importance, and laws determining plant distribution. Importation and acclimatization of foreign plants. Variation of raw materials and their improvements by breeding and selection. Origin and propagation of horticultural varieties. Bacteriology in its relation to industry. Important diseases of plants. Lectures, with accompanying demonstrations and lantern views. *M*, *W*, at 8. Museum Lecture room. *Second semester.* Dr. BURNS.

ZOOLOGY

7. The Fish and Fisheries of Michigan. This course treats of the fresh water fishes, their habits, commercial value, mode of capture and of propagation. Excursions will be made for collecting and to observe commercial fishing operations and propagation. The course is designed for forestry students, but is open to others without prerequisites. *One hour, to be arranged.* Professor REIGHARD.

LAW

a. Torts and Criminal Processes; together with State and Federal laws for the protection of forest property and for the promotion of forestry. *Two hours through the year.* Professors WILGUS, BUNKER and ROTH.

b. Law of Real Property; fixtures, easements, landlord and tenant, together with practise work in some phases of conveyancing. *Two hours, first semester.* Professors THOMPSON, BREWSTER, and Mr. HOLBROOK.

SURGERY

In this course the student learns a few of the simpler methods of surgery and medicine which are to enable the forester to give some help in emergency cases as they arise in camp life. The student also acquaints himself with such remedies and equipment as should be carried by every camping party when in the field for a considerable period. About eight lectures. *Time and hours to be arranged. No credit allowed.* Professor NANCREDE, or Assistants.

The following sequence of studies is recommended, will usually prove feasible and should be closely adhered to.

FIRST YEAR:

Mathematics, courses 1 and 2........... 8*hrs.*
French or German " 1 and 2... ....8*hrs.*
Biology " 1 and 2......... ..8*hrs.*
Rhetoric " 1 and 2 ....6*hrs.*

SECOND YEAR

Botany courses 7 and 12...8*hrs,*
Geology " 1 and 7....6*hrs.*
Physics " 1 and 2....8*hrs.*
Chemistry " 1 and 2, 1a and 2a, *eight hours.*

THIRD YEAR

Forestry course 1 and 7. ...7*hrs.*
Surveying 4 and 2........6*hrs.*
Mechanical Engineering 3..4*hrs.*
Zoology 4....... ....4*hrs.*
Botany 10 ....5*hrs.*
Political Economy 2..... ..4*hrs.*

FOURTH YEAR

Forestry 2a and b; 3a and b, and 6..............15*hrs.*
Zoology 8 and 8a and 3....9*hrs.*
Mineralogy 1..............2*hrs.*
Law (Torts, etc.)..........4*hrs.*

FIFTH YEAR

Forestry, Courses 2c, 4, 5 and 8...............17 *hrs.*
Political Economy 29.......3 *hrs.*
Botany 13.................3 *hrs.*
Zoology 19................3 *hrs.*
Electives, preferably engineering work and law......4 *hrs.*

REQUIREMENTS FOR ADMISSION

All applicants for admission to the Studies in Forestry should apply to the Dean of the Department of Literature, Science, and the Arts. This is true of special students as well as candidates for the degree.

Candidates for a Master's Degree in Forestry must be not less than twenty years of age and must produce certificates of good moral character. In addition, they must conform to the following requirements of the Graduate School of the University:

All applicants for admission to Graduate work in Forestry must first report to the Dean of the Department of Literature, Science, and the Arts, and present their credentials. They will then be referred to the Secretary of the Administrative Council of the Graduate School for the arrangement of the courses of study.

The privileges of the Graduate School are open to graduates of the Department of Literature, Science, and the Arts of this University, and to graduates of other universities and colleges, who satisfy the Administrative Council that they are qualified to pursue with profit the advanced courses of study offered in the school.

Graduates of institutions where the undergraduate courses of study are not substantially equivalent to the course prescribed at this University, if admitted to the graduate school, are ordinarily required to do an additional amount of undergraduate work, or to prolong their term of residence as candidates for a higher degree.

Persons over twenty-one years of age who wish to pursue studies in this department, without becoming candidates for a degree, may be admitted as special students, provided they pass an examination in English, and show that they are qualified to pursue profitably the studies they may desire to take up. In the examination in English, applicants will be asked to write brief essays on subjects that will be assigned, and to answer questions on the rudiments of English grammar.

FEES AND EXPENSES

Matriculation Fee.—Every student before entering any department of the University is required to pay a matriculation fee. This fee, which, for a student of Michigan, is ten dollars, and for a person who comes from any other State or country, twenty-five dollars, is paid but once, and entitles the student to the privileges of permanent membership in the University.

Annual Fee.—In addition to the matriculation fee, every student has to pay an annual fee for incidental expenses. This fee is paid the first year of residence at the University, and every year of residence thereafter. Resident graduates are required to pay the same annual fee as undergraduates. The annual fee in the Department of Literature, Science, and the Arts, is, for Michigan students, thirty dollars; for all others, forty dollars.

Laboratory Expenses.—Students who pursue laboratory courses of study are required to pay for the materials and apparatus actually consumed by them. The deposits required in advance are different for the different courses, ranging from one to twenty dollars. The laboratory expenses of students will vary with their prudence and economy.

Diploma Fee.—The fee for the diploma given on graduation is ten dollars, and the by-laws of the Board of Regents prescribe that no person shall be recommended for a degree until he has paid all his dues, including the fee for diploma.

Other Expenses.—Students obtain board and lodging in private families for from three to five dollars a week. Clubs are also formed in which the cost of board is from one dollar and a half to two dollars and a half per week. Room rent varies from seventy-five cents to two dollars a week for each student.

DEGREE

On completion of the course in Forestry as above outlined, the student is entitled to the degree of Master of Science in Forestry.

THE UNIVERSITY YEAR

The University Year is divided into two semesters, which, for the year 1905-1906 are arranged as follows: First Semester, from September 24, 1905, to February 9, 1906; second semester, from February 12, 1906, to June 21, 1906.

Examinations for admission to the Department of Literature, Science, and the Arts are held September 20, 1905, and February 9, 1906.

OPENING FOR FORESTERS

The question will naturally be asked: ''What are my chances for work if I take the course in Forestry?" The answer to this is not as easy as with regard to some other courses, for the reason that forestry, the right use and care of woods, in our country is in its infancy,—it is just beginning.

Generally speaking, we may say that the woodlands of our country, the field of action of our forester, cover several hundred million acres; that the greater part is culled, cut and burned over; that even today about eighty million people, with a most extraordinary and constantly increasing consumption of wood, depend upon a judicious use of what there is left of the old forests on these woodlands, and that the most diligent care of the woods will be necessary to guard against a serious disturbance in our economic relations, which probably can not be avoided entirely.

It will require the trained heads and hands of several thousand good men to start the work of improving our woods, and it will require the continuous effort for all time of many thousands more to continue the work successfully.

Fortunately it may be said that a general awakening to the needs of better treatment of woodlands has taken place. All classes of people are beginning to realize a few simple but important truths: That not all land is plowland; that it is poor business to destroy a forest and throw away the land when with a little care it might be logged and still a valuable forest be left for future use; that it is wasteful to leave the large areas (in the aggregate) of non-agriculture lands in a non-productive waste-land condition.

As a consequence of this awakening, guided and promoted especially by the intelligent and energetic efforts of the United States Department of Agriculture in its Bureau of Forestry, hundreds of owners of woodlands have of late called for the advice and assistance of men trained in the right use and care of woods. That this demand for help will increase is certain, and it is reasonable even to beleive that quite a rapid increase of this demand may be looked for. As it is, there are hundreds of estates now in charge of untrained men, who are unable to provide more than mere patrol service, while the service of a trained man would not cost any more and would certainly yield larger returns.

Besides the owners of estates whose lands are held for various reasons, there are numerous parties engaged in dealing in timber land for the purposes of direct exploitation (lumbering) or for speculation, who employ well-paid men as "timber-lookers," "estimators" or "cruisers," to perform the work of timber or forest survey, usually with a view to determine the present market value of the woods. That a trained man who sees not only the merchantable stem but also appreciates and is able to report intelligently all features which make up the forest and its wealth, would be more useful than the untrained man, would seem to require no argument. The trained timber surveyor, then, should replace the untrained "timber-looker."

That this view is beginning to be held by our business men is best illustrated by the following letter received in 1904 from the experienced president of one of the most extensive business organizations in our State:

"It has been customary in our Mining Department to keep on our force of young men, graduates of the Mining Schools, who commence in humble positions at small salaries, and if they show ability and character, are promoted from time to time, to positions of responsibility.

"I thought it might be wise to follow out the same thing in connection with our Land Department. Our company controls over a half million acres of forest land. We necessarily have more or less woodsmen constantly employed not only to estimate and look after trespassers and placing monuments, but we also have work for them in the office, keeping up the record, making maps, etc.

"Why is it not equally practicable and wise for young graduates from the forestry schools to enter into subordinate positions of this kind, in order that they may gradually grow up into positions of responsibility and management? Of course, to be a woodsman and timber estimator would require lots of time and experience for the graduates of the forestry school, but they would get out into the woods with experienced men, and thus learn general woodcraft and estimating, and I would like to have two or three technically trained young men of this kind, of good general education, also of good character, who had been trained to estimate timber just as well as regular woodsmen, and who could be sent out to do it, or superintend doing it, at any time, Surveying, map making and keeping up the records, would also be in their regular line of work.

"We are doing considerable work also in the way of road making, and want to do more in that line, so as to improve the roads in our country, and also to see that the money expended for that purpose by the township officials, is spent in a better and more scientific manner than is generally the case.

"I would not want to bother with any young men, unless they are willing to commence at the bottom, and could be undoubtedly recommended for good character and industry. Do you think you have any such men that you could recommend to me? I should also be glad to have your own ideas or any suggestions that you may care to make, in this line of thought."

Since the above letter was written the demand for foresters has increased to such a remarkable degree that the United States Forest Service saw fit to publish a special circular setting forth the fact that places were seeking the men; that a number of positions at salaries up to $2500 per year had been filled by men recommended by the Bureau and that additional places were vacant for lack of men to fill them.

The experiences of the young men who have gone from forest schools in our country, have been encouraging. Not a single one of the entire number, who was properly equipped to take a forester's position at all, is without a position, and no one is serving at a salary of less than $1000 per year, surely a most remarkable showing for young men fresh from school.

As to the prospective forester himself, he should be a man of good physique, good disposition, frugal habits, absolute honesty, and thorough training. Half prepared men are of little use in forestry, especially in this beginning stage of the profession in our country. The forestry graduate in Germany goes into service under an experienced, well trained master, just as our graduate does in railway service. The forestry graduate in our country must plan for himself and may often have to persuade his employer of the needs of any plan at all.

It is strong, well prepared men therefore that are wanted in forestry, but to these the profession not only assures a good living, but a life of highest usefulness and interest.

UNIVERSITY BULLETIN

NEW SERIES, VOL. VII, NO. 2

Walter Mulford

UNIVERSITY OF MICHIGAN
DEPARTMENT OF LITERATURE, SCIENCE AND THE ARTS

ANNOUNCEMENT
OF THE WORK IN
FORESTRY

1906-1907

1837

ANN ARBOR, MICHIGAN
PUBLISHED BY THE UNIVERSITY
1906

COURSES IN FORESTRY

The Courses in Forestry are given in the Department of Literature, Science, and the Arts.

OFFICERS OF ADMINISTRATION AND INSTRUCTION

JAMES BURRILL ANGELL, LL.D., PRESIDENT.

RICHARD HUDSON, LL.D., *Professor of History and Dean of the Department of Literature, Science and the Arts.*

FILIBERT ROTH, B.S., *Professor of Forestry.*

WALTER MULFORD, B.S.A., F.E., *Assistant Professor of Forestry.*

ISAAC NEWTON DEMMON, LL.D., *Professor of English and Rhetoric.*

MORTIMER ELWYN COOLEY, M.E., *Professor of Mechanical Engineering.*

WOOSTER WOODRUFF BEMAN, A.M., *Professor of Mathematics.*

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——————————, *Professor of Geology.*

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JAMES HENRY BREWSTER,PH.B., LL.B., *Professor of Conveyancing.*

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ROBERT EMMET BUNKER, A.M., LL.B., *Professor of Law.*

FRED NEWTON SCOTT, PH.D., *Professor of Rhetoric.*

MAX WINKLER, PH.D., *Professor of the German Language and Literature.*

MOSES GOMBERG, SC.D., *Professor of Organic Chemistry.*

FREDERICK CHARLES NEWCOMBE, PH.D., *Professor of Botany.*

EDWARD DAVID JONES, PH.D., *Assistant Professor of Commerce and Industry.*

ALFRED C. LANE, PH.D., *State Geologist Lecture on Economic Geology.*

OBJECTS

In establishing Courses in Forestry in the University of Michigan, in June, 1901, the principal aims of the University were as follows:

To train young men in forestry.

To promote Forestry in the State of Michigan.

To assist in the proper care of State Forest lands.

To care for the University Forestry Reserves.

To promote forestry, or the right use and improvement of our woods and woodlands, the University is expected to co-operate with the State Forest Commission in bringing the important subject of Forestry before the people of our State through publication and addresses, and also to assist owners of woodlands with advice and with personal direction on the ground.

At the present time the State of Michigan has over six million acres of lands which have reverted for non-payment of taxes. A small portion of these lands has already been set aside as *forest reserves*, and the friends of forestry are urging the immediate increase of these reserves and the establishment of a permanent State forest. Though but three years in operation, the work of the forest reserves is well underway. A "forester" and two regular "forest rangers" watch over the interests of the State and furnish to these wild lands the much needed protection against fire and other injury. In addition, some improvements have been undertaken. Under the direction of the professor of forestry, who acts as "Warden" to these reserves, over 350,000 young trees have been planted on the denuded "slash" lands, and a nursery has been established in which over two millions of young trees are growing today. The policy of the State as developed so far, is to do two principal things:

To give protection to these lands against fire and other injury and thus enable whatever young growth exists, to grow into useful material.

To improve the lands by actually restocking them with tree growth, re-establish a forest where fires have left a blackened waste.

The wisdom of this action has commended itself strongly to the people all over the state, and even in the districts where the reserves are located. the state's policy is meeting with hearty co-operation, so that the continuance of this policy appears assured.

In the training of men in the work of caring for our woods and of improving the present conditions of our woods and woodlands, the general conditions of our country and the consequent needs of the men will form the principal guide in shaping the courses of study, as well as in their presentation.

FACILITIES FOR INSTRUCTION

By referring to the Uniuersity Calendar for 1905–6, it will be seen that facilities for pursuing the fundamental and accessory studies of language, mathematics, physics, chemistry, botany, zoology, etc., are amply provided for.

For field work the vicinity of Ann Arbor offers the best opportunities. Convenient rural street car systems take the student, at very moderate cost, to a variety of hard wood and swamp forests, where all conditions from the virgin woods to the slash are met with, and where a study of the results of good and bad work are well calculated to prepare the student for his future task. In addition, a few hours' ride by steam car suffices to reach the pineries of the Southern Peninsula, the home of the famous Michigan pine, where cut-over lands, dotted here and there with tracts of good pine, and occasionally by patches of second growth, present the many conditions of the great problem of reforestation and offer reliable hints for future management.

To introduce the student into the actual business of caring for such lands and their improvement, it is the intention to have him partake of the real work of caring for the State lands, and thus begin under proper supervision to practice what he has learned.

In the forestry laboratory students receive instruction in forest botany, timber physics, structure of woods, and certain features of wood technology, as well as in forest measurement and the methods of study of the growth of timber. A good collection of wood specimens, sections of trees, and herbarium material is provided and will be increased as rapidly as possible. There is an ample supply of microscopes, compasses, calipers, height measures, and other aparatus for use in the laboratory and in the field.

The forestry library contains over 350 volumes, including practically all of the well recognized authorities in forestry. This library is steadily growing, a department fund for its increase having been allowed.

Eleven journals on forestry, besides a number of technical papers representing different phases of timber exploitation, are regularly received.

Certain special facilities for the study of forestry are supplied by the Saginaw Forest Farm, a tract of land about one mile west of the city of Ann Arbor, presented to the University by Hon. Arthur Hill of Saginaw. The farm comprises eighty acres, and is a typical example of the low hilly land of the drift district, and contains as great a variety of topographical and soil conditions as could be expected in an area of this extent. Its soils vary from heavy clay to sandy gravel, and, in addition to its other good features, has a lake of clear water, from ten to fifty feet deep and covering an area of about twelve acres.

The farm is to serve as an object lesson in forestry. Upon it provision is to be made for (1) an arboretum of all useful forest trees that can grow in Michigan; (2) demonstration areas for seed-bed and nursery work; (3) model plantations of forest trees, and (4) special experiments in forestry, relating to the various methods of propogating different kinds of timber, to the raising of particular forest products, and to other practical purposes.

Through the kindness especially of the Lufkin Rule Company of Saginaw; E. C. Atkins & Co., manufacturers of the famous Atkins saws; the Champion Tool & Handle Works of Evart, Mich., and others, a very ample and select set of woodman's tools has been added to the equipment of the school.

A large album, presented by President J. D. Hawks of the D. & M. Ry., and containing probably the most complete set of photographic views of Michigan lumbering, forms one of the most valuable additions to the forestry library.

The absence of any well-regulated forests, similar to those of many European countries, might be regarded as a serious drawback in the educational facilities, since such woods represent the goal to be attained. However, in the United States the student prepares himself for a task quite different from that of managing a forest as a superior officer, with the woods, the market, the forest officers and laborers all completely and permanently organized and prepared. His duty will largely be that of caring for wild woods, for cut- and burned-over lands, and the improvement of badly mismanaged wood-lots, where everything is new, everything yet to be done, the forest to be made, the help to be organized and trained, the market to be sought and improved, and the people of the district to be convinced of the usefulness of the forest and the necessity of its proper protection. For these reasons it is believed that the field-work in forests where the wild wood conditions have existed for centuries, and under the very conditions which the American forester has to face in actual practice, will prove fully as instructive as work under settled conditions, and perhaps even more useful.

THE COURSE IN FORESTRY

The course in forestry is a graduate course, requiring five years of college work, and leads to the degree of Master of Science in Forestry.

The student who enters the University with a view to studying forestry is expected to take his degree in Arts (A.B.) at the end of the fourth year and to receive his degree in Forestry at the end of the fifth year.

The candidate for the degree in forestry is required to finish the studies enumerated in the following program. Exceptions are made only by special permission.

Program of Studies

FIRST YEAR

Mathematics,	courses 1 and 2	*8hrs.*
Spanish, French or German	" 1 and 2	*8hrs.*
Biology	" 1 and 2	*8hrs.*
Rhetoric	" 1 and 2	*6hrs.*

SECOND YEAR

Botany courses 7 and 12	*8hrs.*
Geology " 1 and 7	*6hrs.*
Physics " 1 and 2	*8hrs.*
Chemistry " 1 and 2, 1a and 2a	*8hrs.*

THIRD YEAR

Forestry, courses 1 and 7	*7hrs.*
Surveying 4 and 2	*6hrs.*
Mechanical Engineering 3	*4hrs.*
Zoology	*4hrs.*
Botany 13	*3hrs.*
Political Economy 2	*4hrs.*

FOURTH YEAR

Forestry, courses 2a and b; 3a and b, and 6	*15hrs.*
Zoology	*8 hrs.*
Mineralogy 1	*2hrs.*
Law (Torts, etc.)	*4hrs.*

FIFTH YEAR

Forestry, courses 2c, 4, 5 and 8	*17hrs.*
Political Economy 29	*3hrs.*
Botany 9	*3hrs.*
Electives. preferably engineering work and law	*7hrs.*

The sequence of studies as above outlined is recommended, will usually prove feasible and should be closely adherred to.

Students who begin the study of forestry after graduating from this or other colleges of University standing are also expected to finish the courses above outlined, or their equivalents, and will generally require two years to do so.

DESCRIPTION OF COURSES

A. PRELIMINARY WORK

The general scope of the courses of study above enumerated is indicated, in brief, as follows:

Spanish, French and German.—A study of the grammar, with the reading of modern prose and practice in speaking and writing.

Rhetoric.—Practical work in English composition, writing and criticising essays.

Political Economy.—Elementary treatment of such topics as Production, Exchange, Distribution, and the History of Industrial Society.

Mathematics.—Advanced Algebra, together with the Elements of Plane Trigonometry and Analytic Geometry.

Physics.—A year of advanced study of the subjects of Mechanics, Sound, Light, Heat and Electricity.

Chemistry.—After a year's work in general inorganic chemistry, requiring attendance upon lectures, recitations, and laboratory exercises, the student enters upon a systematic course of qualitative analysis.

Mineralogy and Geology.—The instruction in these subjects is designed to acquaint the student with the most characteristic properties of common rocks and minerals, and with some of the most prominent features of the geological structure of the earth's crust.

General Biology.—A study of typical species of plants and animals with reference to structure, function, development, and relationship, designed as introductory to the more advanced work in botany and zoology.

Botany.—General morphology and physiology, involving a study of the structure of the cell and tissue, of organography, cell-theory, mitosis and heredity, and of laboratory technique.

Zoology (*a*) Invertebrate Zoology. The structure, classification, distribution, and activities of invertebrate animals.

The laboratory work consists of (1) the dissection of one or more type-forms of each of the groups studied; (2) a study when possible of the instincts of one or more members of each group. The laboratory work is supplemented by occasional field excursions for the study of animals in their natural habitats, and for collecting.

(*b*) Vertebrate Zoology. The structure, classification, distribution, and habits of vertebrate animals. Lectures with practical work in field and laboratory. The field work will be definitely planned and regularly carried out and will include observations of the habits of the native fishes, amphibia, reptiles, birds, and mammals, and the collection of specimens to be kept living or to be preserved.

B. SPECIAL WORK IN ALLIED SUBJECTS

ENGINEERING

Surveying, *Course 4*.—Use of Instruments. *One hour*, *first semester*. Professor DAVIS and Assistant Professor MERRICK.

Largely field work in which the student acquires the ability to use different surveying instruments with reasonable percision.

Topography, *Course 2*.—Transit and stadia, plain table and camera. Field work and drawing. *Five hours*, *second semester*. Professor DAVIS and Mr. MERRICK.

In this course the student learns to do regular surveying work and map making.

Mechanical Engineering, *Course 3*.—Steam Engines. *Four hours*, *first or second semester*. Professor ALLEN.

This course in Mechanical Engineering is intended to acquaint the student with the principles and practice in the use of mechanical devices, such as are used in heavy or bulky materials, and have come into use so extensively in modern logging. Plans are forming for a course specially outlined to meet the requirements of forestry students.

In addition to the above courses it is expected that special lectures will be delivered presenting expert knowledge of certain important phases of Forest Engineering.

BOTANY

9. Morphology and Classification of Fungi. This course deals with morphology, classification, life-history and economic relations of fungi. Students collect and identify material, and become acquainted with the most important literature on the subject. Forestry students elect this course as a four hour course and give special attention to the relation of fungi to forest growth. *Three or more hours*; *hours to be arranged*; *first semester*. Assistant Professor POLLOCK.
10. Experimental Physiology. A study of the relations o plants to

their environment as manifested by the phenomena of nutrition, growth, irritability. 10*a*, *three hours*, 10*b*, *five hours*. Lectures, *Tu*, *Th*, at 8. Room 11, U. H. Laboratory work, *mostly afternoons*. *Second semester*. Professor NEWCOMBE.

13. Biological Relations of Plants. *Two hours*, *to be arranged*. By permission. students who are prepared to take up special problems may elect this course as *three or more hours*. *First semester*. Dr. BURNS.

Factors determining the distribution of plants, association of plants into societies, general distribution of forests, prairies and deserts. Lectures, accompanied by field studies of habits and adaptation, and laboratory work in ecological anatomy.

12. Field Ecology. The identification of trees, shrubs, and herbaceous plants, and their grouping into societies; the relation of plants to light, soil, moisture, and the general factors in the environment. *Two hours*, *second semester*. Dr. BURNS.

4. Economic Botany. Relation of the science of botany to industry. Distribution of plants of commercial importance, and laws determining plant distribution. Importation and acclimatization of foreign plants. Variation of raw materials and their improvements by breeding and selection. Origin and propagation of horticultural varieties. Bacteriology in its relation to industry. Important diseases of plants. Lectures, with accompanying demonstrations and lantern views. *M*, *W*, at 8. Museum Lecture Room. *Second semester*. Dr. BURNS.

ZOOLOGY

7. The Fish and Fisheries of Michigan. This course treats of the fresh water fishes, their habits, commercial value, mode of capture and of propagation. Excursions will be made for collecting and to observe commercial fishing operations and propagation. This course is designed for forestry students, but is open to others without prerequisites. *One hour*, *to be arranged*. Professor REIGHARD.

Forest Entomology. Lectures and field work in the study of injurious and useful insects; and the means of combatting insect injury to forests.

General Vertebrate Zoology. A special course for students in Forestry.

LAW

a. Torts and Criminal Processes; together with State and Federal laws for the protection of forest property and for the promotion of forestry. *Two hours through the year.* Professors WILGUS, BUNKER and ROTH.

b. Law of Real Property; fixtures, easements, landlord and tenant, together with practice work in some phases of conveyancing. *Two hours, first semester.* Professors THOMPSON, BREWSTER, and Mr. HOLBROOK.

SURGERY

In this course the student learns a few of the simpler methods of surgery and medicine which are to enable the forester to give some help in emergency cases as they arise in camp life. The student also acquaints himself with such remedies and equipment as should be carried by every camping party when in the field for a considerable period. About eight lectures. *Time and hours to be arranged. No credit allowed.* Professor DE NANCREDE or Assistants.

C. WORK IN FORESTRY

1. Introduction to Forestry. Lectures. *Four hours, first semestet.* Professor ROTH.

A general presentation of the subject, its history, object and methods, as well as economic importance. This course is intended also for teachers and students of political economy. Open to all students above the second year.

2. Silviculture. Lectures and field work. Assistant Professor MULFORD.

This course is given as follows:

2*a*. Silviculture. Introductory, including the study of soil, climate and other conditions (site) and their influence on forest growth. *Thtee hours, first semester.*

2*b*. Silviculture. Methods of artificial and natural reproduction; seedbed and nursery work; planting and sowing in the forest; reforestation of denuded lands, prairies, dunes, etc. *Three hours, second semester.*

2c. Silviculture. Care of the forest; cleaning and thinning; protection of forests against fire, and other enemies. *Thsee hours, first semestet.*

Courses 2*a*, 2*b* and 2*c* should be taken in order here given. They are open only to students of forestry.

3a and *b*. Forest Mensuration and Description. Lectures, laboratory work, and field work. *Three hours, through the year.* Assistant Professor MULFORD.

Methods of measuring the volume of the individual tree and entire bodies or stands of timber; timber estimating; measurement of the rate of growth of trees and stands; methods and manner of describing a tract of forest to secure its proper management. Open only to forestry students.

4. Forest Utilization. Lectures. *Four hours, second semester.* Professor ROTH.

Use of timber; points of production and market; methods of lumbering, milling, and marketing; minor forest industries.

Open only to forestry students.

5a and *b*. Forest management. Lectures and field work. *Five hours, through the year.* Professor ROTH.

General forest survey and preparation of working plans: administration and regulation of the field and office work in the care of a large tract of timber and the methods of calculations involved in judging the value of forests and forest operations.

Open only to forestry students.

6. Dendrology. Lectures, laboratory work and field work. *Three hours, second semester.* Assistant Professor MULFORD.

Monographic study of forest trees; their life history, distribution, requirements, behavior and possibilities in the forest; forest regions. Open only to forestry students.

7. Timber Physics. Lectures and Laboratory work. *Three hours.* Will not be given in 1906.

REQUIREMENTS FOR ADMISSION

All applicants for admission to the course in Forestry should apply to the Dean of the Department of Literature, Science and the Arts. This is true of special students as well as candidates for the degree.

Candidates for a Master's Degree in Forestry must be not less than twenty years of age and must produce certificates of good moral character. In addition, they must conform to the following requirements of the Graduate School of the University:

All applicants for admission to Graduate work in Forestry must first report to the Dean of the Department of Literature, Science, and the Arts, and present their credentials. They will then be referred to the Secretary of the Administrative Council of the Graduate School for the arrangement of the courses of study.

The privileges of the Graduate School are open to graduates of the Department of Literature, Science and the Arts of this University, and to graduates of other universities and colleges, who satisfy the Administrative Council that they are qualified to pursue with profit the advanced courses of study offered in the school.

Graduates of institutions where the undergraduate courses of study are not substantially equivalent to the course prescribed at this University, if admitted to the graduate school, are ordinarily required to do an additional amount of umdergraduate work, or to prolong their term of residence as candidates for a higher degree.

Persons over twenty-one years of age who wish to pursue studies in this department, without becoming candidates for a degree, may be admitted as special students, provided they pass an examination in English and show that they are qualified to pursue profitably the studies they may desire to take up. In the examination in English, applicants will be asked to write brief essays on subjects that will be assigned, and to answer questions on the rudiments of English grammar.

FEES AND EXPENSES

Matriculation Fee.—Every student before entering any department of the University is required to pay a matriculation fee. This fee, which, for a student of Michigan, is ten dollars, and for a person who comes from any other state or country, twenty-five dollars, is paid but once and entitles the student to the privileges of permanent membership in the University.

Annual Fee.—In addition to the matriculation fee, every student has to pay an annual fee for incidental expenses. This fee is paid the first year of residence at the University, and every year of residence thereafter. Resident graduates are required to pay the same annual fee as undergraduates. The annnal fee in the Department of Literature, Science, and the Arts is, for Michigan students, thirty dollars; for all others, forty dollars.

Laboratory Expenses.—Students who pursue laboratory courses of study are required to pay for the materials and apparatus actually consumed by them. The deposits required in advance are different for the different courses, ranging from one to twenty dollars. The laboratory expenses of students will vary with their prudence and economy.

Diploma Fee.—The fee for the diploma given on graduation is ten dollars, and the by-laws of the Board of Regents prescribe that no person shall be recommended for a degree until he has paid all his dues, including the fee for diploma.

Other Expenses.—Students obtain board and lodging in private families for from three to five dollars a week. Clubs are also formed in which the cost of board is from one dollar and a half to two dollars and a half per week. Room rent varies from seventy-five cents to two dollars a week for each student.

DEGREE

On completion of the course in Forestry as above outlined, the student is entitled to the degree of Master of Science in Forestry.

THE UNIVERSITY YEAR

The University Year is divided into two semesters, which, for the year 1906-1907 are arranged as follows: First Semester, from September 25, 1906, to February 8, 1907; second semester from February 11, 1907, to June 20, 1907.

Examinations for admission to the Department of Literature, Science, and the Arts are held September 19-22, 1906 and February 9, 10, 1907.

OPENING FOR FORESTERS

The question will naturally be asked: "What are my chances for work, if I take the course in forestry?" The answer to this is not as easy as with regard to some other courses, for the reason that forestry, the right use and care of woods, in our country is in its infancy,—it is just beginning.

Generally speaking, we may say that the woodlands of our country, the field of action of our forester, cover several hundred million acres; that the greater part is culled, cut and burned over; that even today about eighty million people, with a most extraordinary and constantly increasing consumption of wood, depend upon a judicious use of what there is left of the old forests on these woodlands, and that the most diligent care of the woods will be necessary to guard against a serious disturbance in our economic relations, which probably cannot be avoided entirely.

It will require the trained heads and hands of several thousand good men to start the work of improving our woods, and it will require the continuous effort for all time of many thousand more to continue the work successfully.

Fortunately it may be said that a general awakening to the needs of better treatment of woodlands has taken place. All classes of people are beginning to realize a few simple and important truths: That not all land is plow land; that it is poor business to destroy a forest and throw away the land when with a little care it might be logged and still a valuable forest be left for future use; that it is wasteful to leave the large areas (in the aggregate) of non-agricultural lands in a non-productive waste-land condition.

As a consequence of this awakening, guided and promoted especially by the intelligent and energetic efforts of the United States Department of Agriculture in its Forest Service, hundreds of owners of woodlands have of late called for the advice and assistance of men trained in the right use and care of woods. That this demand for help will increase is certain, and it is reasonable even to believe that quite a rapid increase of this demand may be looked for. As it is, there are hundreds of estates now in charge of untrained men, who are unable to provide more than mere patrol service, while the service of a trained man would not cost any more and would certainly yield larger returns.

Besides the owners of estates whose lands are held for various reasons, there are numerous parties engaged in dealing in timber land for the purposes of direct exploitation (lumbering) or for speculation, who employ well-paid men as "timber-lookers," "estimators," or "cruisers," to perform the work of timber or forest survey, usually with a view to determining the present market value of the woods, That a trained man who sees not only the merchantable stem but also appreciates and is able to report intelligently all features which make up the forest and its wealth, would be more useful than the untrained man, would seem to require no argument. The trained timber surveyor, then, should replace the untrained "timber-looker."

That this view is beginning to be held by our business men is best illustrated by the following letter received in 1904 from the experienced president of one of the most extensive business organizations in our State:

"It has been customary in our Mining Department to keep on our force of young men, graduates of the Mining Schools, who commence in humble positions at small salaries, and if they show ability and character, are promoted from time to time, to positions of responsibility.

"I thought it might be wise to follow out the same thing in connection with our Land Department. Our company controls over a half million acres of forest land. We necessarily have more or less woodsmen constantly employed not only to estimate and look after trespassers and placing monuments, but we also have work for them in the office, keeping up the records, making maps, etc.

"Why is it not equally practicable and wise for young graduates from the forestry schools to enter into subordinate positions of this kind, in order that they may gradually grow up into positions of responsibility and management? Of course, to be a woodsman and timber estimator would require lots of time and experience for the graduates of the forestry school, but they would get out into the woods with experienced men, and thus learn woodcraft and estimating, and I would like to have two or three technically trained young men of this kind, of good general education, also of good character, who had been trained to estimate timber just as well as regular woodsmen, and who could be sent out to do it, or to superintend doing it, at any time. Surveying, map making and keeping up the records would also be in their regular line of work.

"We are doing considerable work also in the way of road making, and want to do more in that line, so as to improve the roads in our country, and also to see that the money expended for that purpose by the township officials, is spent in a better and more scientific manner than is generally the case.

"I would not want to bother with any young men, unless they are willing to commence at the bottom, and could be undoubtedly recommended for good character and industry. Do you think you have any such men that you could recommend to me? I should also be glad to have your own ideas or any suggestions that you may care to make, in this line of thought."

Since the above letter was written the demand for foresters has increased to such a remarkable degree that the United States Forest Service saw fit to publish a special circular setting forth the fact that places were seeking the men; that a number of positions at salaries up to $1,500 per year had been filled by men recommended by the service and that additional places were vacant for lack of men to fill them.

The experience of the young men who have gone from forest schools in our country, has been encouraging. Not a single one of the entire number, who was properly equipped to take a forester's position at all, is without a position, and no one is serving at a salary of less than $1,000 per year, surely a most remarkable showing for young men fresh from school.

As to the prospective forester himself, he should be a man of good physique, good disposition, frugal habits, absolute honesty, and thorough training. Half prepared men are of little use in forestry, especially in this beginning stage of the profession in our country. The forestry graduate in Germany goes into service under an experienced, well trained master, just as our graduate does in railway service. The forestry graduate in our country must plan for himself and may often have to persuade his employer of the need of any plan at all.

It is strong, well prepared men, therefore, who are wanted in forestry, but to these the profession not only assures a good living, but a life of highest usefulness and interest.

Walter Mulford

UNIVERSITY BULLETIN
NEW SERIES, VOL. IX, No. 2

UNIVERSITY OF MICHIGAN
DEPARTMENT OF LITERATURE, SCIENCE AND THE ARTS

ANNOUNCEMENT
OF THE WORK IN
FORESTRY
1908-1909

ANN ARBOR, MICHIGAN
PUBLISHED BY THE UNIVERSITY
1908

COURSES IN FORESTRY

The Courses in Forestry are given in the Department of Literature, Science, and the Arts.

OFFICERS OF ADMINISTRATION AND INSTRUCTION

JAMES BURRILL ANGELL, LL.D., PRESIDENT.
JOHN OREN REED, PH.D., *Professor of Physics and Dean of the Department of Literature, Science, and the Arts.*
FILIBERT ROTH, B.S., *Professor of Forestry.*
WALTER MULFORD, B.S.A., F. E. *Junior Professor of Forestry.*
ISSAC NEWTON DEMMON, LL.D., *Professor of English.*
MORTIMER ELWYN COOLEY, M.E., *Professor of Mechanical Engineering and Dean of the Department of Engineering.*
WOOSTER WOODRUFF BEMAN, A.M., *Professor of Mathematics.*
VICTOR CLARENCE VAUGHAN, M.D., LLD., *Professor of Hygiene and Physiological Chemistry, Director of the Hygienic Laboratory, and Dean of the Department of Medicine and Surgery.*
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BRADLEY MARTIN THOMPSON, M.S., LL.B., *Jay Professor of Law.*
CHARLES BEYLARD GUERARD DE NANCREDE, M.D. LL.D., *Professor of Surgery and Clinical Surgery in the Department of Medicine and Surgery.*
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JOSEPH BAKER DAVIS, C.E. *Professor of Geodesy and Surveying.*
JACOB REIGHARD, PH. B., *Professor of Zoology.*
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FRED NEWTON SCOTT, PH.D., *Professor of Rhetoric.*
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MOSES GOMBERG, SC.D., *Professor of Organic Chemistry.*
FREDERICK CHARLES NEWCOMBE, PH.D., *Professor of Botany.*
JOHN ROBINS ALLEN, M.E., *Professor of Mechanical Engineering.*
WILLIAM HERBERT HOBBS, PH.D., *Professor of Geology.*
EDWARD HENRY KRAUS, PH.D., *Junior Professor of Mineralogy.*

Objects

In establishing Courses in Forestry in the University of Michigan, in June, 1901, the principal aims of the University were as follows:

To train young men in forestry.

To promote forestry in the State of Michigan.

To assist in the proper care of State Forest lands.

To care for University Forest Reserves,

To promote forestry, or the right use and improvement of our forests and woodlands, the University is expected to co-operate with the State Forest Commission in bringing the important subject of Forestry before the people of our State through publication and addresses, and also to assist owners of woodlands with advice and with personal direction on the ground.

At the present time the State of Michigan has over six million acres of lands which have reverted for non-payment of taxes. A small portion of these lands have already been set aside as *forest reserves*, and the friends of forestry are urging the immediate increase of these reserves and the establishment of a permanent State forest. Though but five years in operation, the work of the forest reserves is well underway. A "forester" and two regular "forest rangers" watch over the interests of the State and furnish to these wild lands the much needed protection against fire and other injury. In addition, some improvements have been undertaken. Under the direction of the professor of forestry, who acts as "Warden" to these reserves several hundred thousand young trees are planted each year on the denuded "slash" lands, and a nursery has been established in which over two millions of young trees are growing today. The policy of the State as developed so far, is to do two principal things:

To give protection to these lands against fire and other injury and thus enable whatever young growth exists, to grow into useful material.

To improve the lands by actually restocking them with tree growth, re-establish a forest where fires have left a blackened waste. The wisdom of this action has commended itself strongly to the people all over the state, and even in the districts where the reserves are located, the state's policy is meeting with hearty co-operation, so that the continuance of this policy appears assured.

In the training of men in the work of caring of our woods and of improving the present conditions of our forests and woodlands, the general conditions of our country and the consequent needs of the men will form the principal guide in shaping the courses of study, as well as in their presentation.

FACILITIES FOR INSTRUCTION

By referring to the University Calender for 1906–7, it will be seen that facilties for pursuing the fundemental and accessory studies of language, mathematics, physics, chemistry, botany, zoology, etc., are amply provided for.

For field work the vicinity of Ann Arbor offers the best opportunities. Convenient rural street car systems take the student, at very moderate cost, to a variety of hard wood and swamp forests, where all conditions from the virgin woods to the slash are met with, and where study of the results of good and bad work are well calculated to prepare the student for his future task. In addition, a few hours' ride by steam car suffices to reach the pineries of the Southern Peninsula, the home of the famous Michigan pine, where cut-over lands, dotted here and there by tracts of good pine, and occasionally by patches of second growth, present the many conditions of the great problem of reforestation and offer reliable hints for future management.

In the forestry laboratory students receive instruction in forest botany, timber physics, structure of woods, and certain features of wood technology, as well as in forest measurement and methods of study of the growth of timber. A good collection of wood specimens, sections of trees, and herbarium material is provided and will be increased as rapidly as possible. There is an ample supply of microscopes, compasses, calipers, height measures, and other aparatus for use in the laboratory and in the field.

The forestry library contains over 400 volumes, including practically all of the well recognized authorities in forestry. This library is steadily growing, a department fund for its increase having been allowed.

Eleven journals on forestry, besides a number of technical papers respresenting different phases of timber exploitation, are regularly received.

Certain special facilities for the study of forestry are supplied by the *Saginaw Forest Farm*, a tract of land about two miles west of the city of Ann Arbor, presented to the University by Hon. Arthur Hill of Saginaw. The farm comprises eighty acres, and is a typical sample of the low hilly land of the drift district, and contains as great a variety of topographical and soil conditions as could be expected in an area of this extent. Its soils vary from heavy clay to sandy gravel, and, in addition to its other good features, has a lake of clear water, from ten to fifty feet deep and covering an area of about twelve acres.

The farm is to serve as an object lesson in forestry. Upon it provision is to be made for (1) an arboretum of all useful forest trees that can grow in Michigan; (2) demonstration areas for seed bed and nursery work; (3) model plantations of forest trees, and (4) special experiments in forestry, relating to the various methods of propogating different kinds of timber, to the raising of particular forest products, and to other practical purposes. These experiments are carried on in co-operation with the U. S. Forest Service.

Through the kindness especially of the Lufkin Rule Company of Saginaw; E. C. Atkins & Co., manufacturers of the famous Atkins saws; the Champion Tool & Handle Works of Evart, Mich. and others, a very ample and select set of woodman's tools has been added to the equipment of the school.

A large collection of photographs presented by President J. D. Hawks of the D. & M. Ry., and containing probably the most complete set of views of Michigan lumbering, forms one of the most valuable additions to the forestry library.

A representative set of lantern slides and a good lantern furnish the necessary illustrations in all courses. The Michigan Forest Reserve where the summer field course is to be given comprises about 40,000 acres of forest and cut-over lands in Roscommon and Crawford counties, about 140 miles north of Ann Arbor. It contains a great variety of forest conditions, extensive plantations, a large nursery and full equipment for work.

The absence of any well regulated [forests, similar to those of many European countries, might be regarded as a serious drawback in the educational facilities, since such woods represent the goal to be attained. However, in the United States the student prepares himself for a task quite different from that of managing a forest as a superior officer, with the woods, the market, the forest officers and laborers all completely and permanently organized and prepared. His duty will largely be that of caring for wild woods for cut- and burned-over lands, and the improvement of badly mismanaged wood-lots, where everything is new, everything yet to be done, the forest to be made, the help to be organized and trained, the market to be sought and improved, and the people of the district to be convinced of the usefulness of the forest and the necessity of its proper protection. For these reasons it is believed that the field-work in forests where the wild wood conditions have existed for centuries, and under the very conditions which the American forester has to face in actual practice, will prove fully as instructive as work under settled conditions, and perhaps even more useful.

THE COURSE IN FORESTRY

The course in Forestry is a graduate course, requiring five years of college work, and leads to the degree of Master of Science in Forestry.

The student who enters the University with a view to studying forestry is expected to take his degree in Arts (A.B.) at the end of the fourth year and to receive his degree in Forestry at the end of the fifth year.

Students who begin the study of forestry after graduating from this or other colleges of University standing are also expected to finish the courses below outlined or their equivalents, and will generally require two years to do so.

The candidate for the degree in forestry is required to finish the studies enumerated in the following program. Exceptions are made only by special permission.

Program of Studies

FIRST YEAR

Mathematics,..........	courses 1 and 2......	*8hrs.*
Spanish, French or German	" 1 and 2......	*8hrs.*
Biology,.	" 1 and 2	*8hrs.*
Rhetoric................ .	" 1 and 2......	*6hrs.*

SECOND YEAR

Botany courses 12 and 13..*6hrs.*	Physics courses 1 and 2..*8hrs.*
Geology " 1 and 2a..*6hrs.*	Chemistry " 1 and 2, 1a and 2a..*8hrs.*

THIRD YEAR

Forestry, courses 1 and 7..*6hrs.*	Zoology 20........ ....*3hrs.*
Surveying, " 4 and 5..*7hrs.*	Botany 7........... .....*5hrs.*
Mechanical Engineering....*3hrs.*	Drawing 10 (Engineer)... .*2hrs.*

FOURTH YEAR

Forestry, courses 2a and 2b; 3a and 3b, and 6.......*15hrs.*
Zoology courses 6 and 7....*4hrs.*
Mineralogy 1..............*2hrs.*
Botany 9.................*3hrs.*
Law (Real Property).......*4hrs.*
Political Economy 1 ....*4hrs.*

SUMMER Between *4th and 5th Year*

Field Course in Forestry 9.............. ..*6 weeks*

FIFTH YEAR

Forestry, courses 2c, 4, 5a, 5b, and 8.............*15hrs.*
Political Economy 29..... *3hrs*
Law, (Real Property and Contracts)..........*5hrs.*

The sequence of studies as above outlined is recommended, will usually prove feasible and should be adhered to.

DESCRIPTION OF COURSES.

A. PRELIMINARY WORK

The general scope of the courses of study above enumerated is indicated, in brief, as follows:

Spanish, French and German.—A study of the grammar, with the reading of modern prose and practice in speaking and writing.

Rhetoric.—Practical work in English composition, writing and criticising essays.

Political Economy.—Elementary treatment of such topics as Production, Exchange, Distribution, and the History of Industrial Society.

Mathematics.—Advanced Algebra, together with the Elements of Plane Trigonometry and Analytical Geometry.

Physics.—A year of advanced study of the subjects of Mechanics, Sound and Light, Heat and Electricity.

Chemistry.—A year's work in general inoganic chemistry, requiring attendance upon lectures, recitations, and laboratory exercises.

Mineralogy and Geology.—The instruction in these subjects is designed to acquaint the student with the most characteristic properties of common rocks and minerals, and with some of the most prominent features of geological structure of the earth's crust.

General Biology.—A study of typical species of plants and animals with reference to structure, function, development, and relationship, designed as introductory to the more advanced work in botany and zoology.

B. SPECIAL WORK IN ALLIED SUBJECTS

ENGINEERING

Surveying, Course 4.—Use of instruments. *Two hours, first or second semester.* Professor DAVIS and Assistant Professor MERRICK.

Largely field work in which the student aquires the ability to use different surveying instruments with reasonable precision.

Topography, Course 5.—Transit and stadia, plain table and camera. Field work and drawing. *Five hours, first or second semester.* Professor DAVIS and Assistant Professor MERRICK.

In this course the student learns to do regular surveying work and map making.

Mechanical Engineering, Course —Special course for forestry students. *Three hours, first semester.* Professor ALLEN.

This course in Mechanical Engineering is intended to acquaint the student with the principles and practice in the use of mechanical devices, such as are used in heavy or bulky materials, and have come into use so extensively in modern logging.

In addition to the above courses it is expected that special lectures will be delivered presenting expert knowledge of certain important phases of Forest Engineering.

BOTANY

7. General Morphology and Physiology. *Five hours.* Lectures, *Tu, Th,* at 8. Room 12, U. H. Laboratory work, *afternoons.* Professor NEWCOMBE.

   Cell structure, tissue structure, and organography; the cell theory, mitosis, and heredity; instruction in technique.

9. Morphology and Classification of Fungi. This course deals with morphology, classification, life-history and economic relations of fungi. Students collect and identify material, and become acquainted with the most important literature on the subject. Forestry students elect this course as a four hour course and give special attention to the relation of fungi to forest growth. *Three or more hours; hours to be arranged; first semester.* Assistant Professor POLLOCK.

12. Field Ecology. The identification of trees, schrubs, and herbaceous plants, and their grouping into societies; the relation of plants to light, soil, moisture, and the general factors in the environment. *Three hours, second semester.* Dr. BURNS.

13. Biological Relations of Plants. *Three hours, to be arranged.* By permission, students who are prepared to take up special problems may elect this course as *three or more hours. First semester.* Dr. BURNS.

    Factors determining the distribution of plants, association of plants into societies, general distribution of forests, prairies and deserts. Lectures, accompanied by field studies of habits and adaptation, and laboratory work in ecological anatomy.

ZOOLOGY

20. Short Course in Zoology. *Three hours.* Two class meetings. *Tu, Th,* at 11. Room 12, U. H. One laboratory or demonstration period to be arranged. Dr. NEWMAN.

    This course aims to present, in brief outline, by means of a text-book, the more important facts concerning the animal kingdom and to illustrate them by specimens. It thus gives a bird's-eye view of the whole subject not possible in the more special courses. It is intended for forestry students, and as a review course for those preparing to teach zoology, but may be taken by others.

7. The Fish and Fisheries of Michigan. *One hour, W,* at 11. Room 12, U. H. Professor REIGHARD.

    This course treats of the fresh-water fishes, their habits, commercial value, mode of capture and of propogation. Excursions will be made for collecting and to observe commercial fishing operations and propagation. The course is designed for forestry students, but is open to others without prerequisites.

6. Entomology, *Three hours.* Lectures, *Tu,* at 10. Room 12, U. H. Two laboratory or field periods. Dr. CASTEEL.

    A course in the habits, life histories, and structure of insects. While seeking to acquaint the student with insect life and structure in general, the course is especially adapted to meet the needs of forestry students and those particularly interested in the economic phases of entomology.

LAW

Real Property II.—Landlord and tenant, fixtures, remainders, executory interests, reversions, Rule in Shelley's Case, rule against perpetuities. Text-book. Two hours a week. Professor THOMPSON.

Real Property III.—Easements, including water rights; transfer of estates *inter vivos.* Text-book. Two hours a week. Professor THOMPSON.

Real Property IV.—Transfer of estates by will, by adverse possession, etc.; mortgages, liens, chattel mortgages. Text-book. Two hours a week. Professor THOMPSON.

Contracts. Formation of a contract, including public policy. Text-book and cases. Three hours a week. Professor KNOWLTON.

SURGERY

In this course the student learns a few of the simpler methods of surgery and medicine which are to enable the forester to give some help in emergency cases as they arise in camp life. The student also acquaints himself with such remedies and equipment as should be carried by every camping party when in the field for a considerable period. About eight lectures. *Time and hours to be arranged. No credit allowed.* Professsor DE NANCREDE or Assistants.

C. WORK IN FORESTRY

1. Introduction to Forestry. Lectures. *Four hours, first semester.* Professor ROTH.
   A general presentation of the subject, its history, object and methods, as well as economic importance. Should be preceded by Botany 12 and 13. Open to students not in forestry, by permission only.
2. Silviculture. Lectures and field work. Junior Professor MULFORD. This course must be preceded by Botany 7, 12 and 13 and by Forestry 1. Course 2c must be preceded by Zoology 6 (Entomology). The course continues through three semesters, and should be taken in the following order:

2a. Silviculture. Introductory, including the study of soil, climate and other site factors, with their influence on forest growth; influences exerted by fhe forest upon climate, stream flow, soil, etc.; forest description. *Three hours, first semester.*

2b. Silviculture. Artificial and natural reproduction of forest; forest extension. Includes practice in seedbed and nursery work, forest planting and sowing. *Three hours, second semester.*

2c. Silviculture. Care of the forest, including thinning; protection of forests against fire and other enemies. *Three hours, first semester.*

Courses 2a, 2b, and 2c are open only to forestry students.

3a and 3b. Forest Mensuration. Lectures, laboratory and field work. *Three hours, through the year. (3a, first semester; 3b, second semester.)* Junior Professor MULFORD.

Methods of measuring the volume of the individual tree and of entire stands of timber; timber estimating; study of the rate of growth and yield of individual trees and of entire stands.

Open only to forestry students.

4. Forest Utilization. Lectures. *Four hours, second semester.* Professor ROTH.

Use of timber; points of production and market; methods of lumbering, milling and marketing; minor forest industries.

Open only to forestry students.

5a and 5b. Forest Management. Lectures and field work. *Four hours, through the year.* Professor ROTH.

General forest survey and preparation of working plans: administration and regulation of the field and office work in the care of a large tract of timber and the methods of calculations involved in judging the value of forests and forest operations.

Open only to forestry students.

6. Dendrology. Lectures, laboratory work and field work. *Three hours, second semester.* Junior Professor MULFORD.

Monographic study of forest trees; their life history, distribution, requirements, behavior and possibilities in the forest; forest regions.

Open only to forestry students.

7. Timber Physics. Lectures and Laboratory work. *Two hours.* Professor ROTH and Mr. STEPHEN.

8. Seminary in Forestry. Special treatment of selected topics. *Two or three hours per week, through the year. No credit allowed.*

9. Field Course in Forestry. Surveying, mapping, forest description, measuring and estimating timber, and general collection of data for a working plan, thinnings, seedbed and plantation work; also laying out of roads and other work in connection with exploitation.

Six weeks, July 1 to Aug. 15. This course is given at the State Forest Reserve in Roscommon county. It must be preceded by 2a and 2b, 3a and 3b.

REQUIREMENTS FOR ADMISSION

All applicants for admission to the course in Forestry should apply to the Dean of the Department of Literature, Science, and the Arts. This is true of special students as well as candidates for the degree.

Candidates for a Master's Degree in Forestry must be not less than twenty years of age and must produce certificates of good moral character. In addition they must conform to the following requirements of the Graduate School of the University:

All applicants for admission to Graduate work in Forestry must first report to the Dean of the Department of Literature, Science, and the Arts, and present their credentials. They will then be referred to the Secretary of the Administrative Council of the Graduate School for arrangement of the courses of study.

The privileges of the Graduate School are open to graduates of the Department of Literature, Science, and the Arts of this University, and to graduates of other universities and colleges, who satisfy the Administrative Council that they are qualified to pursue with profit the advanced courses of study offered in the school.

Graduates of institutions where the undergraduate courses of study are not substantially equivalent to the course prescribed at this University, if admitted to the graduate school, are ordinarily required to do an additional amount of undergraduate work, or to prolong their term of residence as candidates for a higher degree.

Persons over twenty-one years of age who wish to pursue studies in this department, without becoming candidates for a degree, may be admitted as special students, provided they pass an examination in English and *show that they are qualified to pursue profitably* the studies they may desire to take up. In the examination in English, applicants will be asked to write brief essays on subjects that will be assigned, and to answer questions on the rudiments of English grammar.

FEES AND EXPENSES

Matriculation Fee.—Every student before entering any department of the University is required to pay a matriculation fee. This fee, which, for a student of Michigan, is ten dollars, and for a person who comes from any other state or country, twenty-five dollars, is paid but once and entitles the student to the privileges of permanent membership in the University.

Annual Fee.—In addition to the matriculation fee, every student has to pay an annual fee for incidental expenses. This fee is paid the first year of residence at the University, and every year of residence thereafter. Resident graduates are required to pay the same annual fee as undergraduates. The annual fee in the Department of Literature, Science, and the Arts is, for Michigan students, thirty dollars; for all others, forty dollars.

Laboraoty Expenses.—Students who pursue laboratory couses of study are required to pay for the materials and apparatus actually consumed by them. The deposits required in advance are different for the different courses, ranging from one to twenty dollars. The laboratory expenses for students will vary with their prudence and economy.

Diploma Fee.—The fee for the diploma given on graduation is ten dollars, and the by-laws of the Board of Regents prescribe that no person shall be recommended for a degree until he has paid all his dues, including the fee for diploma.

Other Expenses.—Students obtain board and lodging in private families for from three and a half to six dollars a week. Clubs are also formed in which the cost of board is from two dollars to three and a half per week. Room rent varies from seventy-five cents to two dollar a week for each student.

For Course 9 in Forestry $25 extra should be allowed.

DEGREE

On completion of the course in Forestry as above outlined, the student is entitled to the degree of Master of Science in Forestry.

THE UNIVERSITY YEAR

The University Year is divided into two semesters, which, for the year 1908-1909 are arranged as follows: First Semester, from September 29, 1908, to February 12, 1909; second semester from February 15, 1909, to June 26, 1909.

Examinations for admission to the Dapartment of Literature, Science and the Arts are held September 23-28. 1908 and February 12, 13, 1909.

OPENING FOR FORESTERS

The question will naturally be asked: "What are my chances for work, if I take the course in foresty? The answer to this is not as easy as with regard to some other courses, for the reason that forestry, the right use and care of woods, in our country is in its infancy,—it is just beginning.

Generally speaking, we may say that the woodlands of our country, the field of action of our forester, cover several hundred million acres; that the greater part is culled, cut and burned over; that even today about eigty million people, with a most extraordinary and constantly increasing consumption of wood, depend upon a judicious use of what there is left of the old forests on these woodlands, and that the most diligent care of the woods will be necessary to guard against a serious disturbance in our economic relations, which probably can not be avoided entirely.

It will require the trained heads and hands of several thousand good men to start the work of improving our woods, and it will require the continuous effort for all time of many thousand more to continue the work successfully.

Fortunately it may be said that a general awakening to the needs of better treatment of woodlands has taken place. All classes of people are beginning to realize a few simple and important truths: That not all land is plow land; that it is poor business to destroy a forest and throw away the land when with a little care it might be logged and still a valuable forest be left for future use; that it is wasteful to leave the large areas (in the aggregate) of non-agricultural lands in a non-productive waste-land condition.

As a consequence of this awakening, guided and promoted especially by the intelligent and energetic efforts of the United States Department of Agriculture in its Forest Service, hundreds of owners of woodlands have of late called for the advice and assistance of men trained in the right use and care of woods. That this demand for help will increase is certain, and it is reasonable even to believe that quite a rapid increase of this demand may be looked for. As it is, there are hundreds of estates now in charge of untrained men, who are unable to provide more than mere patrol service, while the service of a trained man would not cost any more and would certainly yield larger returns.

Besides the owners of estates whose lands are held for various reasons, there are numerous parties engaged in dealing in timber land for the purposes of direct exploitation (lumbering) or for speculation, who employ well-paid men as "timber-lookers," "estimators," or "cruisers," to perform the work of timber or forest survey, usually with a view to determining the present market value of the woods. That a trained man who sees not only the merchantable stem but also appreciates and is able to report intelligently all features which make up the forest and its wealth, would be more useful than the untrained man, would seem to require no argument. The trained timber surveyor, then, should replace the untrained "timber-looker."

That this view is beginning to be held by our business men is best illustrated by the following letter received in 1904 from the experienced president of one of the most extensive business organizations in our State:

"It has been customary in our Mining Department to keep on our force of young men, graduates of the Mining Schools, who commence in humble positions at small salaries, and if they show ability and character, are promoted from time to time, to positions of responsibility.

"I thought it might be wise to follow out the same thing in connection with our Land Department. Our company controls over a half million acres of forest land. We necessarily have more or less woodsmen constantly employed not only to estimate and look after trespassers and placing monuments, but we also have work for them in the office, keeping up the records, making maps, etc.

"Why is it not equally practicable and wise for young graduates from the forestry schools to enter into subordinate positions of this kind, in order that they may gradually grow up into positions of responsibility and management? Of course, to be a woodsman and timber estimator would rquire lots of time and experience for the graduates of the forestry school, but they would get out into the woods with experienced men, and thus learn woodcraft and estimating, and I would like to have two or three technically trained young men of this kind, of good general education, also of good character, who had been trained to estimate timber just as well as regular woodsmen, and who could be sent out to do it, or to superintend doing it, at any time. Surveying, map making and keeping up the records would also be in their regular line of work.

"We are doing considerable work also in the way of road making, and want to do more in that line, so as to improve the roads in our country, and also to see that the money expended for that purpose by the township officials, is spent in a better and more scientific manner than is generally the case.

"I would not want to bother with any young men, unless they are willing to commence at the bottom, and could be undoubtedly recommended for good character and industry. Do you think you have any such men that you could recommend to me? I should also be glad to have your own ideas or any suggestions that you may care to make, in this line of thought.''

Since the above letter was written the demand for foresters has increased to such a remarkable degree that the United States Forest Service saw fit to publish a special circular setting forth the fact that places were seeking the men; that a number of positions at salaries up to $1,500 per year had been filled by men recommended by the service and that additional places were vacant for lack of men to fill them.

The experience of the young men who have gone from forest schools in our country, has been encouraging. Not a single one of the entire number, who was properly equipped to take a forester's position at all, is without a position, and no one is serving at a salary of less than $1,000 a year, surely a most remarkable showing for young men fresh from school.

As to the prospective forester himself, he should be a man of good physique, good disposition, frugal habits, absolute honesty, and thorough training. Half prepared men are of little use in forestry, especially in this beginning stage of the profession in our country. The forestry graduate in Germany goes into service under an experienced, well trained master, just as our graduate does in railway service. The forestry graduate in our country must plan for himself and may often have to persuade his employer of the need of any plan at all.

It is strong, well prepared men, therefore, who are wanted in forestry, but to these the profession not only assures a good living, but a life of highest usefulness and interest.

Walter Mulford

UNIVERSITY BULLETIN
NEW SERIES, VOL. X, No. 12

UNIVERSITY OF MICHIGAN
DEPARTMENT OF LITERATURE, SCIENCE,
AND THE ARTS

ANNOUNCEMENT
OF THE WORK IN
FORESTRY

1909-1910

ANN ARBOR, MICHIGAN
PUBLISHED BY THE UNIVERSITY
1909

COURSE IN FORESTRY

The Course in Forestry is given in the Department of Literature, Science, and the Arts.

OFFICERS OF ADMINISTRATION AND INSTRUCTION

JAMES BURRILL ANGELL, LL.D., PRESIDENT.
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WALTER MULFORD, B.S.A., F.E., *Junior Professor of Forestry.*
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WILLIAM HERBERT HOBBS, PH.D., *Professor of Geology.*
JOHN ROBINS ALLEN, M.E., *Professor of Mechanical Engineering.*
EDWARD HENRY KRAUS, PH.D., *Junior Professor of Mineralogy and Petrography, and Secretary of the Summer Session.*

AIMS

In establishing a Course in Forestry in the University of Michigan, in June, 1901, the principal aims of the University were as follows:

To train young men for the forestry profession.
To promote forestry in the State of Michigan.
To assist in the proper care of State Forest Lands.
To care for University Forest Reserves.

To promote forestry, or the right use and improvement of our forests and woodlands, the University is expected to cooperate with the State Forest Commission in bringing the important subject of forestry before the people of our state through publication and addresses, and also to assist owners of woodlands with advice and with personal direction on the ground.

At the present time, the State of Michigan has over six million acres of land which have reverted for non-payment of taxes. A small portion of these lands has already been set apart as *forest reserves,* and the friends of forestry are urging the immediate increase of these reserves and the establishment of a permanent State forest. Though but six years in operation the work of the forest reserves is well under way. The professor of forestry acts as "Warden" to these reserves, and under his direction two forest rangers watch over the interests of the State. The policy of the State regarding these reserves, as thus far developed, is to do two principal things:

To give protection against fire and other injury, and thus enable whatever young growth exists to grow into useful material.

To improve the lands by restocking them with trees, thus reestablishing forests where fires have left blackened wastes. Several hundred thousand young trees are planted each year on the denuded "slash" lands, and a nursery has been established in which over two millions of young trees are growing.

The wisdom of this action has commended itself strongly to the people all over the State, and even in the districts where the reserves are located, the State's policy is meeting with hearty co operation, so that the continuance of this policy seems assured.

In the training of men for the work of improving our forests and woodlands, the general conditions of our country and the consequent needs of the men will form the principal guide in shaping the courses of study and the method of presenting them.

FACILITIES FOR INSTRUCTION

By referring to the University Calendar for 1908-9 it will be seen that facilities for pursuing the fundamental and accessory studies of language, mathematics, physics, chemistry, botany, zoology, geology, mineralogy, engineering, law, etc., are amply provided.

For field work the vicinity of Ann Arbor offers the best of opportunities. Convenient rural street car systems take the student, at very moderate cost, to a variety of hardwood and swamp forests, where all conditions from the virgin woods to the "slash" are met with, and where study of the results of good and bad work is well calculated to prepare the student for his future task. In addition, a few hours' ride by railroad suffices to reach the pineries of the Southern Peninsula, the home of the famous Michigan pine, where cut-over lands, dotted here and there by tracts of good pine, and occasionally by patches of second growth, present the many conditions of the great problem of reforestation and offer reliable hints for future management.

Certain special facilities for the study of forestry are supplied by the *Saginaw Forest Farm,* a tract of land about two miles west of the city of Ann Arbor, presented to the University by Hon. Arthur Hill of Saginaw. The farm comprises eighty acres, and is a typical sample of the low hilly land of the drift district. Its soils vary from heavy clay to sandy gravel. Its topography is varied, including slopes with various exposures, a small swamp area, and a lake from ten to fifty feet deep covering an area of about twelve acres. The farm serves as an object lesson in forest plantations and in nursery work. Upon it there are: (1) a forest nursery; (2) model plantations of forest trees; (3) special experiments in forestry, relating to the various methods of propagating different kinds of timber, to the raising of particular forest products, and to other practical purposes. Fifty plantations have been established on this tract.

Within fifteen minutes' walk of the campus is the University Botanical Garden and Arboretum, a tract of about ninety acres which is being rapidly developed. This will include, among many other features, an arboretum of all useful forest trees that can be grown in this climate.

In the forestry laboratory students receive instruction in forest botany, timber physics, structure of woods, and certain features of wood technology, as well as in forest measurement and methods of study of the growth of timber. A good collection of wood specimens, sections of trees, and herbarium material is provided. There is an ample supply of microscopes, compasses, calipers, height measures, and other apparatus for use in the laboratory and in the field.

The forestry library contains over 600 bound volumes, including practically all of the well recognized authorities in forestry. This library is steadily growing, a department fund for its increase having been allowed. Eleven forestry journals, besides a number of technical papers representing different phases of timber exploitation, are regularly received.

A representative collection of photographs and lantern slides furnishes the necessary illustrations in all courses.

Through the kindness of various manufacturers, an ample set of woodsman's tools is included in the equipment.

The Michigan Forest Reserve, where the summer field course is to be given, comprises about 40,000 acres of forest and cut-over lands in Roscommon and Crawford counties, about 140 miles north of Ann Arbor. It contains a great variety of forest conditions, extensive plantations, a large nursery and full equipment for work.

The absence of any well regulated forests, similar to those of many European countries, might be regarded as a serious drawback in the educational facilities, since such forests represent the goal to be attained. However, in the United States the student prepares himself for a task quite different from that of managing a forest as a superior officer, with the woods, the market, the forest officers and laborers all completely and permanently organized and prepared. His duty will largely be that of caring for cut and burned-over lands, and the improvement of badly mismanaged forests, where everything is new, everything yet to be done, the forest to be made, the help to be organized and trained, the market to be sought and improved, and the people of the district to be convinced of the usefulness of the forest and the necessity of its proper protection. For these reasons it is believed that field work under the very conditions which the American forester has to face in actual practice, will prove fully as instructive as work under settled conditions, and perhaps even more useful.

THE COURSE IN FORESTRY

The course in forestry is a graduate course, leading to the degree of Master of Science in Forestry. It requires either five or six years of college work, as explained below.

There are two main classes of forestry students:

(A) Those who enter this University as undergraduates with the purpose of studying forestry. Such students are expected to take the degree of Bachelor of Arts at the end of their fourth year, and the degree of Master of Science in Forestry at the end of the fifth year.

(B) Those who begin the study of forestry as graduate students (except candidates for the doctorate). If they have had proper scientific preparation, such students require two years to complete the course in forestry and receive the degree of Master of Science in Forestry.

In addition to the above, there are two other classes of forestry students: (C) Candidates for the doctorate (Doctor of Philosophy or Doctor of Science) may elect one or both minors in forestry. (D) Under very exceptional circumstances, special students will be admitted (see "Requirements for Admission").

No one (with very rare exceptions in the case of undergraduate special students) will be allowed to complete all the courses in forestry as an undergraduate. At least the last year of the work must be taken as a graduate student.

REQUIRED WORK

CLASS A—STUDENTS ENTERING AS UNDERGRADUATES.

Students of Class A are required to finish the courses enumerated in the following program, unless special permission for substitutions is given by the professor of forestry.

FIRST YEAR.

First Semester		*Second Semester.*	
Mathematics, 1	*4hrs.*	Mathematics, 2	*4hrs.*
Biology, 1	*4hrs.*	Biology, 2	*4hrs.*
Rhetoric, 1	*3hrs.*	Rhetoric, 2	*3hrs.*
Chemistry, 1 and 1a	*4hrs.*	Chemistry, 2 and 2a	*4hrs.*

SECOND YEAR.

First Semester.		*Second Semester.*	
Spanish, 1; German, 1; or French, 1	*4hrs.*	Spanish, 2; German, 2; or French, 2	*4hrs.*
Physics, 1	*4hrs.*	Physics, 2	*4hrs.*
Geology, 1	*3hrs.*	Geology, 2	*3hrs.*
Botany, 13	*3hrs.*	Botany, 12	*3hrs.*
		Surveying, 4	*2hrs.*

THIRD YEAR.

First Semester.		*Second Semester.*	
Drawing, 10	*2hrs.*	Forestry, 1	*4hrs.*
Mechanical Engineering,		Forestry, 7	*2hrs.*

24	*3hrs.*	Surveying, 5	*3hrs.*
Botany, 7	*5hrs.*	Zoology, 6	*3hrs.*
Zoology, 20	*3hrs.*		

FOURTH YEAR.

First Semester.		*Second Semester.*	
Forestry, 2a	*3hrs.*	Forestry, 2b	*3hrs.*
Forestry, 3a	*3hrs.*	Forestry, 3b	*3hrs.*
Botany, 9	*3hrs.*	Zoology, 7	*3hrs.*
Mineralogy, 1	*2hrs.*	Mineralogy, 9	*2hrs.*
Political Economy, 1	*4hrs.*		

SUMMER BETWEEN FOURTH AND FIFTH YEARS.

Forestry, 9 (Field Work) .... *8 weeks.*

FIFTH YEAR.

First Semester.		*Second Semester*	
Forestry, 2c	*3hrs.*	Forestry, 5b	*4hrs.*
“ 4	*4hrs.*	“ 6	*3hrs.*
“ 5a	*4hrs.*	“ 8	*no credit.*
“ 8	*no credit.*		

All forestry students are expected to visit courses in law. The courses especially recommended are Real Property II, III and IV, and Contracts. Students receive no credit for these courses.

In addition to the above program, any University course to which the student is eligible may be elected by him, to complete the number of hours of work necessary for graduation.

CLASS B—STUDENTS ENTERING AS GRADUATES (EXCEPT CANDIDATES FOR THE DOCTORATE).

Students of Class B are required to finish all the courses in forestry, with the possible exception of Course 1; and to take such courses in the allied subjects as the professor of forestry may determine. The work required of each student will be adapted to suit his previous training. The aim will be to complete as far as possible the equivalent of the program of studies required of the students of Class A.

CLASS C—CANDIDATES FOR THE DOCTORATE.

CLASS D—SPECIAL STUDENTS.

The course will be especially arranged by the professor of forestry to suit the needs of each candidate for the doctorate and of each special student.

DESCRIPTION OF COURSES

A. SPECIAL WORK IN ALLIED SUBJECTS.

(The following list includes required courses and a few of the elective courses which are especially desirable for forestry students.)

ENGINEERING

Surveying, Course 4. Use of Instruments. Lectures and field practice. *Two hours, either semester.* Professor DAVIS and Assistant Professor MERRICK.

Linear measurements. Field notes. Verniers. Angle reading. Traverse surveying. Computing areas. Platting. Leveling. Profile. Grade line. Straight line.

Surveying, Course 5. Topography, field work and drafting. *Three hours, either semester.* Professor DAVIS and Assistant Professor MERRICK.

Transit and stadia, plane table and camera surveying. Must be preceded by Course 4 or its equivalent.

Drawing, Course 10. Free-hand Lettering. *Two hours, first or second semester.*

This course is designed to give the student practice in the simple forms of letters used in the drafting room and the laying out of titles.

Mechanical Engineering, Course 24. Prime Movers. *Three hours, first semester.* Lectures, *M, W, F,* at 9. Professor ALLEN.

This course is offered primarily for forestry students. It embraces a study of the steam engine, gas engine, and water turbine, together with the study of the various methods of transmitting the power from these prime movers. This subject is covered in a popular way and in addition, attention is given to the operation of the various machines.

This course should be preceded by Courses 1 and 2 in Physics.

BOTANY

5. Plant Culture and Breeding. *Three hours, first semester.* One lecture and six hours' laboratory work a week, at *hours to be arranged.* Room 2, U. H. Dr. HUS.
   This course attempts to lay the foundation for a knowledge of the modern art and science of plant culture and breeding. It will include a study of the conditions for growth, the relations of plants to soils, the functions of parts, and the various means used to produce and propagate varieties, such

as selection, budding, grafting, cross-fertilization, and hybridizing.

7. General Morphology and Physiology. *Five hours, first semester.* Lectures, *Tu, Th,* at 8. Room 12, U. H. Laboratory work, *afternoons.* Professor Newcombe.
Cell structure, tissue structure, and organography; the cell theory, mitosis, and heredity; instruction in technique.

9. Morphology and Classification of Fungi. *Three or more hours, first semester.* Lecture, *F,* at 9. Laboratory work, *M* and *W,* 1 to 4. Assistant Professor Pollock.
The first part of the semester will be spent in collecting and classifying fungi, with special reference to those forms causing diseases of trees. The latter work will include the study of the larger groups, and the preparation of lists of literature and reports on assigned topics.

10. Experimental Physiology. This course may be elected as 10*a, three hours;* 10*b, five hours, second semester.* Lectures, *Tu, Th,* at 8. Room 12, U. H. Laboratory work, *mostly afternoons.* Professor Newcombe.
A study of the relations of plants to their environment as manifested by the phenomena of nutrition, growth, and irritability.

12. Field and Forest Botany. *Three hours, second semester.* Lecture, *Tu,* at 1. Museum Lecture Room. Assistant Professor Burns.
Laboratory Work:
Sec. I, *Tu, Th,* 2-6.
Sec. II, *F,* 1-5; *S,* 8-12.
Classification of woody plants; identification of trees and shrubs; relation of plants to light, soil, moisture, and the general factors of the environment; the identification of woods by lens and microscope.
Course 12 must be preceded by Course 13, or its equivalent, by undergraduate students.

13. Biological Relations of Plants. *Three hours, first semester.* Lecture, *Tu,* at 1. Museum Lecture Room. Assistant Professor Burns.
Laboratory work:
Sec I., *Tu, Th,* 2-6.
Sec. II, *F,* 1-5, *S,* 8-12.
Study of the plant societies about Ann Arbor, with special reference to plants occurring in various types of wood-lots; an analysis of the factors governing the various habitats for plant growth; study of ecological plant anatomy.

32. Principles of Landscape Gardening. Lectures, readings, reports and field work. *Hours to be arranged, second semester.* Mr. Simonds and Assistant Professor Burns.

This course may be taken as 1*a, two hours credit,* or 1*b, four hours credit.* In case it is taken as 1*a,* the reports and part of the field work will be omitted.

This course is designed to meet the needs of teachers, students of forestry, students of architecture, and others who wish to acquire a knowledge of landscape gardening, but is only open to students who have completed their second year or its equivalent at the University. The lectures will be illustrated by a study of local examples, including work on private and public grounds, and by a study of maps and final reports on various problems of landscape gardening.

ZOOLOGY

6. Entomology. *Three hours, second semester.* Lectures, *Tu, Th,* at 11. Room 12, U. H. One laboratory or field period *Tu,* 1-4. Room 4, U. H. Dr. Hegner.

   A course in the habits, life histories, and structure of insects. While seeking to acquaint the student with insect life and structure in general, the course is especially adapted to meet the needs of forestry students and of those particularly interested in the economic phases of entomology.

7. The Fish and Game of Michigan. The Natural History, preservation and propagation of the fishes, birds and mammals of economic importance. *Three hours, second semester.* Lectures, *M, W,* at 11. Room 14, U. H. One laboratory or field period, *Th.,* 1-4. At least four Saturdays must be given to field excursions. (Arrangements will be made so that this does not conflict with field work in Forestry, Course 3b.) Professor Reighard and Dr. Hegner.

   This course treats of the fishes, birds and mammals of Michigan, their classification, habits, economic importance, mode of capture, preservation and propagation. Excursions will be made for the observation of habits, for collecting and for the study of commercial fishing operations and propagation. The course is designed for forestry students, but is open to others.

20. Short Course in Zoology. *Three hours, first semester.* Two class meetings, *Tu, Th,* at 11. Room 12, U. H. Laboratory or demonstration period. *F,* 1-4. Room 13, U. H. Dr. Pearse.

    This course aims to present, in brief outline, by means of a text-book, the more important facts concerning the animal kingdom and to illustrate them by specimens. It thus gives a bird's-eye view of the whole subject not possible in the more special courses. It is intended for forestry students, and as a review course for those preparing to teach zoology, but may be taken by others.

GEOLOGY

1. Elements of Geology. Lectures and recitations, supplemented by excursions during the open season and by laboratory work during the winter months. *Three hours, either semester.* Lectures, *M, W,* at 11; several quiz sections, *F,* at 8, 9, and 10. Museum Lecture Room. Excursions *Saturday morning.* Professor Hobbs, Mr. Scott, and assistants.

2. Historical Geology. *Three hours, second semester.* Lectures, *M, W, F,* at 10. Laboratory work, *one hour a week. F, at time to be arranged.* Assistant Professor Case and Mr. Willoughby.

   An outline history of the development of the continent and of the appearance and extinction of plants and animals, from the records in the rocks.

15. Soil Geology. A course especially intended for students of forestry. *Three hours, second semester. M, W, F,* at 9. Geological Laboratory. Mr. Allen.

MINERALOGY AND PETROGRAPHY

1. Elements of Mineralogy. Lectures and laboratory work. *Two hours, either semester.* Lectures, *Tu, Th,* at 11. Laboratory work, *two hours a week, to be arranged.* Mineralogical Lecture Room, T. H. Professor Kraus, Mr. Hunt, and assistants.

   This course includes the elements of crystallography, physical and chemical properties, occurrence, uses, and determination of the more common minerals. For this course a knowledge of elementary inorganic chemistry is necessary.

9. Lithology. Lectures and laboratory work. *Two hours, either semester.* Lectures, *M, W,* at 2. Laboratory work, *two hours a week, to be arranged.* Mr. Hore.

   The lectures include, aside from a review of the rock-forming minerals, a discussion of the origin, modes of occurrence, alterations, methods of determination, and uses of the more important rocks. In the laboratory the student is required to determine by means of the macro-physical properties a large number of rock specimens. Numerous field excursions will also be made in order to acquire facility in the rapid determination of rocks in the field. Prerequisites, Mineralogy 1 and Geology 1.

SURGERY

In this course the student learns a few of the simpler methods of surgery and medicine which are to enable the forester to give some help in emergency cases as they arise in camp life. The student also acquaints himself with such remedies and equipment as should be carried by every camping party when in the field for a considerable period. About eight lectures. *Hours to be arranged. No credit allowed.* Professor De Nancrede or assistants.

LAW

Real Property II.—Landlord and tenant, fixtures, remainders, executory interests, reversions, Rule in Shelley's Case, rule against perpetuities. Text-book. Two hours a week. Professor Thompson.

Real Property III.—Easements, including water-rights; transfer of estates *inter vivos.* Text-book. Two hours a week. Professor Thompson.

Real Property IV.—Transfer of estates by will, by adverse possession, etc.; mortgages, liens, chattel mortgages. Text-book. Two hours a week. Professor Thompson.

Contracts. Formation of a contract, including public policy. Text-book and cases. Three hours a week. Professor Knowlton.

B. WORK IN FORESTRY.

The courses in forestry are open only to forestry students. except Course 1, which may be taken by other students, by special permission only.

1. Introduction to Forestry. *Four hours, second semester.* Lectures, *M, Tu, Th, F,* at 10. Room 26, U. H. Professor Roth.

A general presentation of the subject, its history, objects, and methods, as well as economic importance.

2. Silviculture. Lectures and field work. Professor Mulford. Students of Class A must have had Botany 7, 12 and 13 and Forestry 1 before beginning Course 2a, and they must have had Zoology 6 before beginning Course 2c. The course continues through three consecutive semesters, and should be taken in the following order:

2a. Silviculture. *Three hours, first semester.* Lectures, *M, W,* at 8. Room 4, W. H. Field work, *F,* 1-4. Professor Mulford.

Introductory, including forest description; the study of soil, climate, and other site factors, and their influence on forest growth; influences exerted by the forest upon climate, stream flow, soil, etc.

2b. Silviculture. *Three hours, second semester.* Lectures, *M, W,* at 8. Room 4, W. H. Field work, *F,* 1-4. Professor Mulford.

Artificial and natural reproduction of forests; afforestation.

Includes practice in seed bed and nursery work, forest planting and sowing.

2c. Silviculture. *Three hours, first semester.* Lectures, *Tu, Th,* at 8. Room 4, W. H. Field work, *Tu,* 1-4. Professor MULFORD.

Care of forests, including thinning, protection of forests against fire and other enemies.

3*a*. Forest Mensuration. *Three hours, first semester.* Lectures, *F,* at 8. Room 4, W. H. Field and laboratory work, *S,* 8-2:30. Professor MULFORD.

Methods of measuring the volume of the individual tree and of entire stands of timber; timber estimating; study of the rate of growth and yield of individual trees and of entire stands of timber; rough methods of forest survey.

3*b*. Forest Mensuration. Continuation of Course 3*a*. *Three hours, second semester.* Lectures, *F,* at 8. Room 4, W. H. Field and laboratory work, *S,* 8-2:30. Professor MULFORD.

4. Forest Utilization. *Four hours, first semester.* Lectures, *M, Tu, Th, F,* at 10. Room 26, U. H. Professor ROTH.

Uses of timber; points of production and market; methods of lumbering, milling, and marketing; minor forest industries. This course must be preceded by Forestry 2*a* and 2*b*, 3*a* and 3*b*.

5*a*. Forest Management. Lectures and field work. *Four hours, first semester. M, Tu, Th, F,* at 9. Room 26, U. H. Professor ROTH.

General forest surveys and preparation of working plans; administration and regulation of the field and office work in the care of a large tract of timber, and the methods of calculation involved in judging the value of forests and forest operations. Open only to graduate students.

5*b*. Forest Management. Continuation of Course 5*a*. *Four hours, second semester. M, Tu, Th, F,* at 9. Room 26, U. H. Professor ROTH.

6. Dendrology. *Three hours, second semester.* Lectures, *Tu, Th,* at 8. Room 4, W. H. Laboratory work, *Tu,* 1-4. Professor MULFORD.

Monographic study of forest tree species: their classification, identification, distribution, life history, requirements, behavior in the forest, and importance; forest regions.

7. Wood technology. Lectures and laboratory work. *Two hours, second semester. Hours to be arranged.*

8. Seminary. *Two or three hours, to be arranged; no credit allowed; through the year to the spring recess.* Professor ROTH and Professor MULFORD.

Reports on special topics are intended to familiarize the student with the topics themselves, sources of information, and methods of presentation. This course is open only to candidates for the forestry degree in their last year.

9 Field Course in Forestry. *Eight weeks, July and August.* This course is given at the State Forest Reserve in Roscommon County. It must be preceded by courses 2*a* and 2*b*, 3*a* and 3*b* in forestry, and surveying.

Surveying, mapping, forest description, measuring and estimating timber, and general collection of data for a working plan, thinnings, seed bed and plantation work; also laying out of roads and other work in connection with exploitation.

REQUIREMENTS FOR ADMISSION

Students desiring to enter as undergraduates should refer to the Announcement of the Department of Literature, Science and the Arts, for the requirements for admission.

Candidates for the degree of Master of Science in Forestry must be not less than twenty years of age and must produce certificates of good moral character. In addition they must conform to the following requirements of the Graduate School of the university:

All applicants for admission to graduate work in forestry must first report to the Dean of the Department of Literature, Science, and the Arts, and present their credentials. They will then be referred to the Secretary of the Administrative Council of the Graduate School for arrangement of the course of study.

The privileges of the Gradutae School are open to graduates of the Department of Literature, Science, and the Arts of this University, and to graduates of other universities and colleges, who satisfy the Administrative Council that they are qualified to pursue with profit the advanced courses of study offered in the school.

Graduates of institutions where the undergraduate courses of study are not substantially equivalent to the course prescribed at this University, if admitted to the Graduate School, are ordinarily required to do an additional amount of undergradutae work, or to prolong their term of residence as candidates for a higher degree.

Special students will be admitted to forestry courses only, (a) if they are college graduates; or, (b) as under graduates if they have had very extensive experience in forest work of such character as especially fits them for undertaking the forestry courses. Such students must also fulfill the entrance requirements for special students of the Department of Literature, Science and the Arts (see the Announcement of the Department of Literature, Science and the Arts).

Copies of this bulletin, or copies of the general announcement of the Department of Literature, Science and the Arts, may be obtained by addressing the Secretary of the University. General correspondence concerning the course may be addressed to the Professor of Forestry, Ann Arbor. Inquiries concerning entrance requirements or credit for advanced work should be addressed to Dean John O. Reed, The University, and all prospective students are urged to make arrangements concerning entrance as early as possible.

In addition to their regular University registration, all forestry students should register with the Professor of Forestry (Room 4, West Hall), as soon as they arrive, and should not fail to consult with him concerning their work. This is especially necessary the first year of the student's attendance.

FEES AND EXPENSES

Matriculation Fee.—Every student before entering any department of the University is required to pay a matriculation fee. This fee, which for a citizen of Michigan is ten dollars, and for a person who comes from any other state or country, twenty-five dollars, is paid but once, and entitles the student to the privileges of permanent membership in the University.

Annual Fee.—In addition to the matriculation fee, every student has to pay an annual fee for incidental expenses. This fee is paid the first year of residence at the University, and every year of residence thereafter. Resident graduates are required to pay the same annual fee as undergraduates. The annual fee in the Department of Literature, Science, and the Arts is, for Michigan students, thirty dollars; for all others, forty dollars.

Laboratory Expenses.—Students who pursue laboratory courses are required to pay for the materials and apparatus actually consumed by them. The deposits required in advance range from one to twenty dollars. The laboratory expenses for students will vary with their prudence and economy.

Diploma Fee.—The fee for the diploma given on graduation is ten dollars, and the by-laws of the Board of Regents prescribe that no person shall be recommended for a degree until he has paid all his dues, including the fee for diploma.

Other Expenses.—There are no dormitories and no commons connected with the University. Students obtain board and lodging in private families for from three dollars and a half to six dollars a week. Clubs are formed in which the cost of board is from two dollars to three dollars and a half per week. Room rent varies from seventy-five cents to two dollars a week for each student.

Course 9 in Forestry is part of the regular Summer Session and students taking this course must pay the regular tuition of twenty dollars charged for the Summer Session.

Annual Expense.—The total expense for board, room, laundry, tuition, laboratory fees, books, stationery, and miscellaneous expenses connected with the student's work, is from two hundred and fifty dollars per year up, and averages about three hundred dollars per year for students who are careful in their expenditures. This does not include clothing and other personal expenses.

DEGREE

On completion of the course in forestry, the student is entitled to the degree of Master of Science in Forestry.

THE UNIVERSITY YEAR

The University year is divided into two semesters, which, for the year 1909-1910 are arranged as follows: first semester, from October 5, 1909, to February 11, 1910; second semester, from February 14, 1910, to June 30, 1910.

Examinations for admission to the Department of Literature, Science, and the Arts are held September 27-Oct. 1, 1909, and February 10-12, 1910.

OPENING FOR FORESTERS

The question will naturally be asked: "What are my chances for work, if I take the course in forestry?" The answer to this is not as easy as with regard to some other courses, because forestry, the right use and care of forests, in our country is in its infancy.

Broadly speaking, we may say that the woodlands of the United States, the field of action of our foresters, cover several hundred million acres, that the greater part is culled, cut and burned over; that even today about eighty million people, with a most extraordinary and constantly increasing demand for wood, depend upon a judicious use of what there is left of the old forests; and that the most diligent care of the woods is necessary to guard against a serious disturbance in our economic relations, which probably can not be avoided entirely.

It will require the trained heads and hands of several thousand good men to start the work of improving our woods, and it will require the continuous effort for all time of many thousand more to continue the work successfully.

Fortunately it may be said that a general awakening to the needs of better treatment of woodlands has taken place. All classes of people are beginning to realize a few simple and important truths: that not all land is plow land; that it is poor business to destroy a forest and throw away the land when with a little care it might be logged and still leave a valuable forest for future use; that it is wasteful to leave the large areas of non-agricultural lands in a non-productive waste-land condition.

As a consequence of this awakening, guided and promoted especially by the intelligent and energetic efforts of the United States Forest Service, hundreds of forest owners have of late called for the advice and assistance of men trained in the right use and care of woods. That this demand for help will increase is certain, and it is reasonable even to believe that quite a rapid increase of this demand may be looked for. As it is, there are hundreds of estates now in charge of untrained men, who are unable to provide more than mere patrol service, while the service of a trained man would not cost any more and would certainly yield larger returns.

Besides the owners of estates whose lands are held for various reasons, there are numerous parties engaged in dealing in timber land for the purpose of direct exploitation (lumbering) or for speculation, who employ well-paid men as "timber-lookers," "estimators," or "cruisers," to make timber or forest surveys, usually with a view to determining the present market value of the woods. That a trained man who sees not only the merchantable stem, but also appreciates and is able to report intelligently all features which make up the forest and its wealth, would be more useful than the untrained man, would seem to require no argument. The trained timber surveyor, then, should replace the untrained "timber-looker."

As to the prospective forester himself, he should be a man of good physique, good disposition, frugal habits, absolute honesty, and thorough training. Half prepared men are of little use in forestry, especially in this beginning stage of the profession in our country. The forestry graduate in Europe goes into service under an experienced, well-trained master, just as the American graduate does in railway service. The forestry graduate in our country must plan for himself and may often have to persuade his employer of the need of any plan at all.

It is strong, well prepared men, therefore, who are wanted in forestry, but to these the profession not only assures a good living, but a life of highest usefulness and interest.

ENTERED AS SECOND-CLASS MATTER AT THE POSTOFFICE AT ANN ARBOR, MICHIGAN.

Walter Mulford

UNIVERSITY BULLETIN
NEW SERIES, VOL. XI, No. 2

UNIVERSITY OF MICHIGAN
DEPARTMENT OF LITERATURE, SCIENCE,
AND THE ARTS

ANNOUNCEMENT
OF THE COURSE IN
FORESTRY

1910-1911

1837

ANN ARBOR, MICHIGAN
PUBLISHED BY THE UNIVERSITY
1910

COURSE IN FORESTRY

The Course in Forestry is given in the Department of Literature, Science, and the Arts.

OFFICERS OF ADMINISTRATION AND INSTRUCTION

HARRY BURNS HUTCHINS, PH.B., LL.D., ACTING PRESIDENT, *and Dean of the Department of Law.*

JOHN OREN REED, PH.D., *Professor of Physics and Dean of the Department of Literature, Science, and the Arts.*

FILIBERT ROTH, B.S., *Professor of Forestry.*

WALTER MULFORD, B.S.A., F.E., *Junior Professor of Forestry.*

CARY LEROY HILL, A.B., M.S.F., *Assistant Professor of Forestry.*

ISAAC NEWTON DEMMON, A.M., LL.D., *Professor of English.*

MORTIMER ELWYN COOLEY, M.E., LL.D., *Professor of Mechanical Engineering and Dean of the Department of Engineering.*

WOOSTER WOODRUFF BEMAN, A.M., *Professor of Mathematics.*

VICTOR CLARENCE VAUGHAN, PH.D., M.D., LL.D., *Professor of Hygiene and Physiological Chemistry, Director of the Hygienic Laboratory, and Dean of the Department of Medicine and Surgery.*

HENRY CARTER ADAMS, PH.D., LL.D., *Professor of Political Economy and Finance.*

BRADLEY MARTIN THOMPSON, M.S., LL.B., *Jay Professor of Law.*

CHARLES BEYLARD GUERARD DE NANCREDE, A.M., M.D., LL.D., *Professor of Surgery and Clinical Surgery in the Department of Medicine and Surgery.*

JOSEPH BAKER DAVIS, C.E., *Professor of Geodesy and Surveying.*

JACOB REIGHARD, PH.B., *Professor of Zoology and Director of the Zoological Laboratory and the Zoological Museum.*

ARTHUR GRAVES CANFIELD, A.M., *Professor of Romance Languages.*

FRED NEWTON SCOTT, PH.D., *Professor of Rhetoric.*

MAX WINKLER, PH.D., *Professor of the German Language and Literature.*

MOSES GOMBERG, SC.D., *Professor of Organic Chemistry.*

FREDERICK CHARLES NEWCOMBE, PH.D., *Professor of Botany, in Charge of the Botanical Laboratory.*

WILLIAM HERBERT HOBBS, PH.D., *Professor of Geology.*

JOHN ROBINS ALLEN, M.E., *Professor of Mechanical Engineering.*

S. LAWRENCE BIGELOW, PH.D., *Professor of General and Physical Chemistry.*

EDWARD HENRY KRAUS, PH.D., *Junior Professor of Mineralogy and Petrography, and Secretary of the Summer Session.*

GEORGE PLUMER BURNS, PH.D., *Assistant Professor of Botany and Director of the Botanical Garden.*

CHARLES PHILIP WAGNER, PH.D., *Assistant Professor of Romance Languages.*

AIMS

In establishing a course in forestry in the University of Michigan, in June, 1901, the principal aims of the University were as follows:

To train young men for the profession of forestry.
To promote forestry in the State of Michigan.
To assist in the proper care of State Forest Lands.
To care for University Forest Reserves.

In the training of men for the profession of forestry, the aim of the University is to develop strong, mature men; men with both a broad general outlook and a thorough knowledge of the essential details of forestry. Such men are demanded by the profession, because of the great variety of conditions under which the foresters of our country must work, because of the many obstacles which beset the introduction of new ideas, and because of the unusual responsibilities which are early put upon the American forester.

In the promotion of forestry in the State of Michigan, the forestry faculty has for six years assisted the State Forest Commission in bringing the need of forestry to the attention of the people of the State. During this time, the Professor of Forestry served as "Warden" or technical officer of the State Forest Commission, and organized and conducted the work on the State Forest Reserves. By legislative enactment, the general forestry work in the State and the management of the State Forest Reserves are now in the hands of the "Commission of Public Domain." The University is represented on this Commission by one of its Regents, and thus continues its policy of active promotion of this much-needed work in the State.

FACILITIES FOR INSTRUCTION

By referring to the University Calendar it will be seen that facilities for pursuing the fundamental and accessory studies of language, mathematics, physics, chemistry, botany, zoology, geology, mineralogy, engineering, law, etc., are amply provided.

For field work in forestry the vicinity of Ann Arbor offers the best of opportunities. Convenient rural street car systems take the students, at very moderate cost, to a variety of hardwood and swamp forests, where all conditions are met with, from the virgin woods to the "slash", and where study of the results of good and bad work is well calculated to prepare the student for his future task. A few hours' ride by railroad suffices to reach the pineries of the Southern Peninsula, the home of the famous Michigan pine, where cut-over lands, dotted here and there by tracts of good pine, and occasionally by patches of second growth, present the many conditions of the great problem of reforestation and offer reliable hints for future management.

Special facilities for the study of forestry are supplied by the *Saginaw Forest Farm*, a tract of land about two miles west of the city of Ann Arbor, presented to the University by Hon. Arthur Hill of Saginaw. The farm comprises eighty acres, and is a typical sample of the low hilly land of the drift district. Its soils vary from heavy clay to sandy gravel. Its topography is varied, including slopes with various exposures, a small swamp area, and a lake from ten to fifty feet deep covering an area of about twelve acres. The farm serves as an object lesson in forest plantations and in nursery work. Upon it there are: (1) a forest nursery; (2) model plantations of forest trees; (3) special experiments in forestry, relating to the various methods of propagating different kinds of timber, to the raising of particular forest products, and to other practical purposes. Fifty plantations have been established on this tract.

A large area of other lands in the vicinity of Ann Arbor has been placed under the management of the Forestry School. Parts of these lands are wooded and offer opportunity for a variety of work in mensuration and silviculture. Considerable portions of these lands are old fields which are being planted to forest at the rate of over one hundred acres per year.

Within fifteen minutes' walk of the campus is the University Botanical Garden and Arboretum, a tract of about ninety acres which is being rapidly developed. This will include among many other features, an arboretum of all useful forest trees that can be grown in this climate. Ground is also provided in this garden for exact silvicultural experiments.

In the forestry laboratory students receive instruction in forest botany, timber physics, structure of woods, and certain features of wood technology, as well as in forest measurement and methods of study of the growth of timber. A good collection of wood specimens, sections of trees, and herbarium material is provided. There is an ample supply of microscopes, compasses, calipers, height measures, and other apparatus for use in the laboratory and in the field.

The forestry library contains over 800 bound volumes, and is steadily growing, a department fund for its increase having been allowed. Eleven forestry journals, besides a number of technical papers representing different phases of timber exploitation, are regularly received.

A representative collection of photographs and lantern slides furnishes the necessary illustrations in all courses.

Through the kindness of various manufacturers, an ample set of woodsman's tools is included in the equipment.

THE COURSE IN FORESTRY

The course in forestry is a graduate course, leading to the degree of Master of Science in Forestry. It requires either five or six years of college work, as explained below.

There are two main classes of forestry students:

(A) Those who enter this University as undergraduates with the purpose of studying forestry. Such students are expected to take the degree of Bachelor of Arts at the end of their fourth year, and the degree of Master of Science in Forestry at the end of the fifth year.

(B) Those who begin the study of forestry as graduate students (except candidates for the doctorate). If they have had proper scientific preparation, such students require two years to complete the course in forestry and receive the degree of Master of Science in Forestry.

In addition to the above, there are two other classes of forestry students: (C) Candidates for the doctorate (Doctor of Philosophy or Doctor of Science), who may elect one or both minors in forestry. (D) Special students, who will be admitted only under very exceptional circumstances. (See "Requirements for Admission.").

No one (with very rare exceptions in the case of undergraduate special students) will be allowed to complete all the courses in forestry as an undergraduate. At least the last year of the work must be taken as a graduate student.

REQUIRED WORK

CLASS A—STUDENTS ENTERING AS UNDERGRADUATES

Students of Class A are required to finish the course enumerated in the following program, unless special permission for substitutions is given by the professor of forestry.

FIRST YEAR

First Semester		*Second Semester*	
Spanish, German, or French	*4hrs.*	Spanish, German, or French	*4hrs.*
Mathematics, 1	*4hrs.*	Mathematics, 2	*4hrs.*
Biology, 1	*4hrs.*	Biology, 2	*4hrs.*
Rhetoric, 1	*3hrs.*	Rhetoric, 2	*3hrs.*

SECOND YEAR

First Semester		*Second Semester*	
Chemistry, 1 and 1a	*4hrs.*	Chemistry, 2 and 2a	*4hrs.*
Physics, 1	*4hrs.*	Physics, 2	*4hrs.*
Geology, 1	*3hrs.*	Geology, 15	*3hrs.*
Botany, 13	*3hrs.*	Botany, 12	*3hrs.*
Drawing, 10	*2hrs.*	Surveying, 4	*2hrs.*

THIRD YEAR

First Semester		*Second Semester*	
Forestry, 1	*4hrs.*	Forestry, 7	*2hrs.*
Mechanical Engineering, 24	*3hrs.*	Surveying, 5	*3hrs.*
Botany, 7	*5hrs.*	Zoology, 6	*3hrs.*
Zoology, 20	*3hrs.*	Mineralogy, 1	*2hrs.*
		Electives	*6hrs.*

FOURTH YEAR

First Semester		*Second Semester*	
Forestry, 2a	*3hrs.*	Forestry, 2b	*5hrs.*
Forestry, 3a	*4hrs.*	Forestry, 3b	*4hrs.*
Botany, 9	*3hrs.*	Forestry, 4	*4hrs.*
Political Economy. 1	*5hrs.*	Zoology, 7	*3hrs.*

SUMMER BETWEEN FOURTH AND FIFTH YEARS

Forestry, 9 (Field Work)	*8 weeks*

FIFTH YEAR

First Semester		*Second Semester*	
Forestry, 2c	*4hrs.*	Forestry, 5b	*4hrs.*
Forestry, 5a	*4hrs.*	Forestry, 6b	*1hr.*
Forestry, 6a	*2hrs.*	Forestry, 8b	*2hrs.*
Forestry, 8a	*3hrs.*	Mineralogy, 9	*2hrs.*
		Law (Contracts)	*2hrs.*
Law (Real Property, II and IV)	*4hrs.*	Law (Real Property, III)	*2hrs.*

Students desiring more work in language or other special courses should consult the professor of forestry for special arrangement of elections.

In addition to the above program, any University courses to which the student is eligible may be elected by him.

CLASS B—STUDENTS ENTERING AS GRADUATES (EXCEPT CANDIDATES FOR THE DOCTORATE)

Students of Class B are required to finish all the courses in forestry, with the exception of Course 2d, and possibly of Course 1; and to take such courses in the allied subjects as the professor of forestry may determine. The work required of each student will be adapted to suit his previous training. The aim will be to complete as far as possible the equivalent of the program of studies required of the students of Class A.

CLASS C—CANDIDATES FOR THE DOCTORATE

CLASS D—SPECIAL STUDENTS

The course will be especially arranged by the professor of forestry to suit the needs of each candidate for the doctorate and of each special student.

DESCRIPTION OF COURSES

A. SPECIAL WORK IN ALLIED SUBJECTS

The following list includes required courses and a few of the elective courses which are especially desirable for forestry students.

For a complete list of courses see the University Calendar (or the Announcements of the Departments of Literature, Science, and the Arts, of Engineering, and of Law.)

BOTANY

5. Plant Culture and Breeding. *Three hours, first semester.* One lecture and six hours' laboratory work a week, at *hours to be arranged.* Room 2, U. H. Dr. Hus.

   This course attempts to lay the foundation for a knowledge of the modern art and science of plant culture and breeding. It will include a study of the conditions for growth, the relations of plants to soils, the functions of parts, and the various means used to produce and propagate varieties, such as selection, budding, grafting, cross-fertilization, and hybridizing.

7. General Morphology and Physiology. *Five hours, first semester.* Lectures, *Tu*, *Th*, at 8. Room 12, U. H. Laboratory work, *afternoons.* Professor NEWCOMBE.

   Cell structure, tissue structure, and organography; the cell theory, mitosis, and heredity; instruction in technique.

9. Morphology and Classification of Fungi. *Three or more hours, first semester.* Lecture, *F*, at 10. Laboratory work, *M* and *W*, 1 to 4. Assistant Professor POLLOCK.

The first part of the semester will be spent in collecting and classifying fungi, with special reference to those forms causing diseases of trees. The later work will include the study of the larger groups, and the preparation of lists of literature and reports on assigned topics.

10. Experimental Physiology. This course may be elected as 10*a, three hours;* 10*b, five hours, second semester.* Lectures, *Tu, Th*, at 8. Room 12, U. H. Laboratory work, *mostly afternoons.* Professor NEWCOMBE.

A study of the relation of plants to their environment as manifested by the phenomena of nutrition, growth, and irritability.

12. Field and Forest Botany. *Three hours, second semester.* Lecture, *Tu*, at 1. Museum Lecture Room. Assistant Professor BURNS.

Laboratory Work:
Sec. I, *Tu, Th*, 2-6.
Sec. II, *F*, 1-5; *S*, 8-12.

Classification of woody plants; identification of trees and shrubs; relation of plants to light, soil, moisture, and the general factors of the environment; the identification of woods by lens and microscope.

Course 12 must be preceded by Course 13, or its equivalent, by undergraduate students.

13. Biological Relations of Plants. *Three hours, first semester.* Lecture, *Tu*, at 1. Museum Lecture Room. Assistant Professor BURNS.

Laboratory Work:
Sec. I, *Tu, Th*, 2-6.
Sec. II, *F*, 1-5, *S*, 8-12.

Study of the plant societies about Ann Arbor, with special reference to plants occurring in various types of wood-lots; an analysis of the factors governing the various habitats for plant growth; study of ecological plant anatomy.

32. Principles of Landscape Gardening. Lectures, readings, reports and field work. *Hours to be arranged, second semester.* Mr. SIMONDS and Assistant Professor BURNS.

This course may be taken as 1*a, two hours credit*, or 1*b, four hours credit.* In case it is taken as 1*a*, the reports and part of the field work will be omitted.

This course is designed to meet the needs of teachers, students of forestry, students of architecture, and others who wish to acquire a knowledge of landscape gardening, but is only open to students who have completed their second year or its equivalent at the University. The lectures will be illustrated by a study of local examples, including work on private and public grounds, and by a study of maps and final reports on various problems of landscape gardening.

ZOOLOGY

6. Entomology. *Three hours, second semester.* Lectures, *Tu, Th*, at 11. Room 12, U. H. One laboratory or field period *Tu*, 1-4. Room 4, U. H. Dr. Hegner.

   A course in the habits, life histories, and structure of insects. While seeking to acquaint the student with insect life and structure in general, the course is especially adapted to meet the needs of forestry students and of those particularly interested in the economic phases of entomology.

7. The Fish and Game of Michigan. The Natural History, preservation and propagation of the fishes, birds and mammals of economic importance. *Three hours, second semester.* Lectures, *M, W*, at 11. Room 14, U. H. One laboratory or field period, *Th*, 1-4. At least four Saturdays must be given to field excursions. (Arrangements will be made so that this does not conflict with field work in Forestry, Course 3b.) Dr. Hegner. This course treats of the fishes, birds and mammals of Michigan, their classification, habits, economic importance, mode of capture, preservation and propagation. Excursions will be made for the observation of habits, for collecting and for the study of commercial fishing operations and propagation. The course is designed for forestry students, but is open to others.

20. Short Course in Zoology. *Three hours. first semester.* Two class meetings, *Tu, Th*, at 11. Room 12, U. H. Laboratory or demonstration period, *F*, 1-4. Room 13, U. H. Dr. Daniel.

    This course aims to present, in brief outline, by means of a text-book, the more important facts concerning the animal kingdom and to illustrate them by specimens. It thus gives a bird's-eye view of the whole subject not possible in the more special courses. It is intended for forestry students, and as a review course for those preparing to teach zoology, but may be taken by others.

GEOLOGY

1. Elements of Geology. Lectures and recitations, supplemented by excursions during the open season and by laboratory work during the winter months. *Three hours, either semester.* Lectures. *M*, *W*, at 11; quiz sections, *F*, at 8, 9, 10, and 11. Museum Lecture Room. Laboratory sections, *M* or *W* or *F*, 1-3 or 3-5; or *S*, 8-10, or 10-12. Professor HOBBS, Assistant Professor CASE, Mr. SCOTT, and assistants.

2. Historical Geology. *Three hours, either semester.* Lectures, *M*, *W*. *F*, at 10. Laboratory work, *one hour a week, Thursday afternoon.* Assistant Professor CASE and assistant.

   An outline history of the development of the continent and of the appearance and extinction of plants and animals, from the records in the rocks.

15. Soil Geology. *Three hours, second semester. M*, *W*, *F*, at 9. Geological Laboratory.

   A comprehensive survey of the subject including the origin of soils, their physical and chemical constitution, the influence of climate on soil fertility, irrigation and drainage, tillage, fertilizers, etc., and a consideration of the regolith of the United States in relation to geologic, physiographic, and climatic factors.

MINERALOGY AND PETROGRAPHY

1. Elements of Mineralogy. Lectures and laboratory work. *Two hours, either semester.* Lectures, *Tu*, *Th*, at 11. Laboratory work, *two hours a week, to be arranged.* Mineralogical Lecture Room, T. H. Professor KRAUS, Mr. HUNT, and assistants.

   This course includes the elements of crystallography, physical and chemical properties, occurrence, uses, and determination of the more common minerals. For this course a knowledge of elementary inorganic chemistry is necessary.

9. Lithology. Lectures and Laboratory work. *Two hours, either semester.* Lectures, *M*, *W*, at 2. Laboratory work, *two hours a week, to be arranged.* Mr. CLARK.

   The lectures include, aside from a review of the rock-forming minerals, a discussion of the origin, modes of occurrence, alterations, methods of determination, and uses of the more important rocks. In the laboratory the student is required to determine by means of the macro-physical properties a large number of rock specimens. Numerous field excursions will also be made in order to acquire facility in the rapid determination of rocks in the field. Prerequisites, Mineralogy 1 and Geology 1.

ENGINEERING

Surveying, Course 4. Use of Instruments. Lectures and field practice. *Two hours, either semester.* Professor DAVIS and Assistant Professor MERRICK.

Linear measurements. Field notes. Verniers. Angle reading. Traverse surveying. Computing areas. Platting. Leveling. Profile. Grade line. Straight line.

Surveying, Course 5. Topography, field work and drafting. *Three hours, either semester.* Professor DAVIS and Assistant Professor MERRICK.

Transit and stadia, plane table and camera surveying. Must be preceded by Course 4 or its equivalent.

Drawing, Course 10. Free-hand Lettering. *Two hours, either semester.*

This course is designed to give the student practice in the simple forms of letters used in the drafting room and the laying out of titles.

Mechanical Engineering, Course 24. Prime Movers. *Three hours, first semester.* Lectures, *M*, *W*, *F*, at 9. Professor ALLEN.

This course is offered primarily for forestry students. It embraces a study of the steam engine, gas engine, and water turbine, together with the study of the various methods of transmitting the power from these prime movers. This subject is covered in a popular way, and in addition attention is given to the operation of the various machines.

This course should be preceded by Courses 1 and 2 in Physics.

SURGERY

In this course the student learns a few of the simpler methods of surgery and medicine which are to enable the forester to give some help in emergency cases as they arise in camp life. The student also acquaints himself with such remedies and equipment as should be carried by every camping party when in the field for a considerable period. About eight lectures. *Hours to be arranged. No credit allowed.* Professor DE NANCREDE or assistants.

LAW

Real Property II.—Landlord and tenant, fixtures, remainders, executory interests, reversions, Rule in Shelley's Case, rule against perpetuities. Text-book. *Two hours, first semester.* Professor THOMPSON.

Real Property III.—Easements, including water-rights; transfer of estates *inter vivos*. Text-book. *Two hours, second semester.* Professor THOMPSON.

Real Property IV.—Transfer of estates by will, by adverse possession, etc.; mortgages, including liens and chattel mortgages. Text-book. *Two hours, first semester.* Professor THOMPSON.

Contracts.—Operation, interpretation, and discharge of contract. Text-book and cases. *Two hours, second semester.* Professor KNOWLTON.

B. WORK IN FORESTRY

The courses in forestry are open only to forestry students, except Course 1, which may be taken by other students, by special permission only.

1. Introduction to Forestry. Lectures. *Four hours, first semester. M, Tu, Th, F,* at 10. Room 26, U. H. Professor ROTH.
   A general presentation of the subject, its history, objects and methods, as well as economic importance.

2a. Silviculture—The Forest and the Site. Lectures and field work. *Three hours, first semester.* Lectures, *Tu, Th,* at 9. Room 4, W. H. Field work, two sections: Section I, *Tu,* 1-5; Section II, *F,* 1-5. Room 4, W. H. Professor MULFORD.
   Forest description; the study of soil, climate and other site factors, and their influence on forest growth; influences exerted by the forest upon climate, stream-flow, soil, etc.
   (Courses 2a, 2b, and 2c should be taken in three consecutive semesters, in the order named. These courses are open only to seniors and graduate students. Students of Class A must have had Botany 7, 12, and 13, and Forestry 1 before beginning Course 2a.)

2b. Silviculture—Forest Reproduction. Lectures and field work. *Five hours, second semester.* Lectures, *M, Tu, Th, F,* at 8. Room 4, W. H. Field work, two sections: Section I, *Tu,* 1-5; Section II, *F,* 1-5. Room 4, W. H. Professor MULFORD.
   Artificial and natural reproduction of forests; afforestation. The field work includes practice in seed bed and nursery work, forest planting and sowing, and the marking of the trees which should be cut when natural reproduction is to be practised.

2c. Silviculture—Care and Protection of Forests. Lectures and field work. *Four hours, first semester.* Lectures, *Tu, W, Th,* at 8. *Tu, Th,* Room 4, W. H.; *W,* Room 26, U. H. Field work, two sections: Section I, *W,* 1-5; Section II, *Th,* 1-5. Professor MULFORD.

Care of forests, including thinning; protection of forests against fire and other enemies.

2*d*. Silviculture—Silvicultural Problems. Individual work. *Two hours, second semester. Any two afternoons.* Room 4, W. H. Professor MULFORD.

An elective course, open to students who have satisfactorily completed at least one semester's work in silviculture. Each student will be assigned a silvicultural problem for investigation.

3*a*. Forest Mensuration and Survey. Lectures, field and laboratory work. *Four hours, first semester.* Lectures, *W*, *S*, at 8. Room 4, W. H. Field and laboratory work, *S*, 9–5. Assistant Professor HILL.

Methods of measuring the volume of the individual tree and of entire stands of timber; timber estimating; study of the rate of growth and yield of individual trees and of entire stands of timber; rough methods of forest survey.

3*b*. Forest Mensuration and Survey. Continuation of Course 3*a*. *Four hours, second semester.* Lectures, *W*, *S*, at 8. Room 4, W. H. Field and laboratory work, *S*, 9–5. Assistant Professor HILL.

4. Forest Utilization. Lectures. *Four hours, second semester. M, Tu, Th, F*, at 10. Room 26, U. H. Professor ROTH.

Uses of timber; points of production and market; methods of lumbering, milling, and marketing; minor forest industries. This course must be preceded by Forestry 2*a* and 2*b*.

5*a*. Forest Management. Lectures and field work. *Four hours, first semester. M, Tu, Th, F*, at 9. Room 26, U. H. Professor ROTH.

General forest surveys and preparation of working plans; administration and regulation of the field and office work in the care of a large tract of timber, and the methods of calculation involved in judging the value of forests and forest operations. Open only to graduate students.

5*b*. Forest Managment. Continuation of Course 5*a*. *Four hours, second semester. M, Tu, Th, F*. at 9. Room 26, U. H. Professor ROTH.

6*a*. Dendrology. Lectures. *Two hours, first semester. M, F*, at 8. Room 4, W. H. Assistant Professor HILL.

Monographic study of forest tree species: their classification, identification, distribution, life history, requirements, behavio in the forest, and importance; forest regions.

6*b*. Dendrology. Lectures. *One hour, second semester. W*, at 9. Room 4, W. H. Assistant Professor HILL. Continuation of course 6*a*.

7. Wood Technology. Lectures and laboratory work. *Two hours, second semester. Hours to be arranged.* Assistant Professor HILL.

8*a*. Seminary. *Three hours, to be arranged, first semester.* Professor ROTH, Professor MULFORD and Assistant Professor HILL.

Reports on special topics are intended to familiarize the student with the topics themselves, sources of information, and methods of presentation. This course is open only to candidates for the forestry degree in their last year.

8*b*. Seminary. *Two hours, to be arranged; second semester, until the spring recesss.* (The class will meet three times a week). Continuation of Course 8*a*. Professor ROTH, Professor MULFORD and Assistant Professor HILL.

9. Field Course in Forestry. *Eight weeks, July and August.* This course must be preceded by courses 2*a* and 2*b*, 3*a* and 3*b* in forestry, and surveying.

Surveying, mapping, forest description, measuring and estimating timber, and general collection of data for a working plan, thinnings, seed bed and plantation work; also laying out of roads and other work in connection with exploitation.

REQUIREMENTS FOR ADMISSION

Students desiring to enter as undergraduates should refer to the Announcement of the Department of Literature, Science and the Arts, for the requirements for admission.

All applicants for admission to graduate work in forestry must first report to the Dean of the Department of Literature, Science, and the Arts, and present their credentials. They will then be referred to the Secretary of the Administrative Council of the Graduate School for arrangement of the course of study.

The privileges of the Gradute School are open to graduates of the Department of Literature, Science, and the Arts of this University, and to graduates of other universities and colleges, who satisfy the Administrative Council that they are qualified to pursue with profit the advanced courses of study offered in the school.

Graduates of institutions where the undergraduate courses of study are not substantially equivalent to the course prescribed at this University, if admitted to the Graduate School, are ordinarily required to do an additional amount of undergraduate work, or to prolong their term of residence as candidates for a higher degree.

Special students will be admitted to forestry courses only: (a) if they are college graduates; (b) as undergraduates with at least two years of college work beyond high school, if they have had very extensive experience in forest work of such character as especially fits them for undertaking the forestry courses; (c) if the student has had ample preparation to pursue the studies in forestry, but is not preparing himself for forestry as a profession. Such students must also fulfill the entrance requirements for special students of the Department of Literature, Science and the Arts (see the Announcement of the Department of Literature, Science and the Arts).

Copies of this bulletin, or of the general announcement of the Department of Literature, Science and the Arts, or of the University Calendar, may be obtained by addressing the Secretary of the University. General correspondence concerning the course may be addressed to the Professor of Forestry, Ann Arbor. Inquiries concerning entrance requirements or credit for advanced work should be addressed to Dean John O. Reed, the University, and all prospective students are urged to make arrangements concerning entrance as early as possible.

In addition to their regular University registration, all forestry students should register with the Professor of Forestry (Room 4. West Hall), as soon as they arrive, and should not fail to consult with him concerning their work. This is especially necessary the first year of the student's attendance.

FEES AND EXPENSES

Matriculation Fee.—Every student before entering any department of the University is required to pay a marticulation fee. This fee, which for a citizen of Michigan is ten dollars, and for a person who comes from any other state or country, twenty-five dollars, is paid but once, and entitles the student to the privileges of permanent membership in the University.

Annual Fee. In additiou to the marticulation fee, every student has to pay an annual fee for incidental expenses. This fee is paid the first year of residence at the University, and every year of residence thereafter. Resident graduates are required to pay the same annual fee as undergraduates. The annual fee in the Department of Literature, Science, and the Arts is, for Michigan students, thirty dollars; for all others, forty dollars.

Laboratory Expenses. -Students who pursue laboratory courses are required to pay for the materials and apparatus actually consumed by them. The deposits required in advance range from one to twenty dollars. The laboratory expenses for students will vary with their prudence and economy.

Diploma Fee.—The fee for the diploma given on graduation is ten dollars, and the by-laws of the Board of Regents prescribe that no person shall be recommended for a degree until he has paid all his dues, including the fee for diploma.

Other Expenses.—There are no dormitories and no commons connected with the University. Students obtain board and lodging in private families for from three dollars and a half to six dollars a week. Clubs are formed in which the cost of board is from two dollars and a half to three dollars and a half per week. Room rent is from one dollar a week up, for each student.

Course 9 in Forestry is part of the regular Summer Session and students taking this course must pay the regular tuition of twenty dollars charged for the Summer Session.

Annual Expense.—The total expense for board, room, laundry, tuition, laboratory fee, books, stationery, and miscellaneous expenses connected with the student's work, is from two hundred and fifty dollars per year up, and averages about three hundred dollars per year for students who are careful in their expenditures. This does not include clothing and other personal expenses.

DEGREE

On completion of the course in forestry, the student is entitled to the degree of Master of Science in Forestry.

THE UNIVERSITY YEAR

The University year is divided into two semesters, which for the year 1910–1911 are arranged as follows: first semester, from October 4, 1910 to February 10, 1911; second semester, from February 13, 1911, to June 29, 1911.

Examinations for admission to the Department of Literature, Science, and the Arts are held February 10–12, 1910, September 26–30, 1910, and February 9–11, 1911.

OPENING FOR FORESTERS

The question will naturally be asked: "What are my chances for work, if I take the course in forestry?" The answer to this is not as easy as with regard to some other courses, because forestry, the right use and care of forests, in our country is in its infancy.

Broadly speaking, we may say that the woodlands of the United States, the field of action of our foresters, cover several hundred million acres, that the greater part is culled, cut and burned over; that even today about eighty million people, with a most extraordinary and constantly increasing demand for wood, depend upon a judicious use of what there is left of the old forests; and that the most diligent care of the woods is necessary to guard against a serious disturbance in our economic relations, which probably can not be avoided entirely.

It will require the trained heads and hands of several thousand good men to start the work of improving our woods, and it will require the continuous effort for all time of many thousand more to continue the work successfully.

Fortunately it may be said that a general awakening to the needs of better treatment of woodlands has taken place. All classes of people are beginning to realize a few simple and important truths: that not all land is plow land; that it is poor business to destroy a forest and throw away the land when with a little care it might be logged and still leave a valuable forest for future use; that it is wasteful to leave the large areas of non-agricultural lands in a non-productive waste-land condition.

As a consequence of this awakening, guided and promoted especially by the intelligent and energetic efforts of the United States Forest Service, hundreds of forest owners have of late called for the advice and assistance of men trained in the right use and care of the woods. That this demand for help will increase is certain, and it is reasonable even to believe that quite a rapid increase of this demand may be looked for. As it is, there are hundreds of estates now in charge of untrained men, who are unable to provide more than mere patrol service, while the service of a trained man would not cost any more and would certainly yield larger returns.

Besides the owners of estates whose lands are held for various reasons, there are numerous parties engaged in dealing in timber land for the purpose of direct exploitation (lumbering) or for speculation, who employ well-paid men as timber-lookers," "estimators," or "crusiers," to make timber or forest surveys, usually with a view to determining the present market value of the woods. That a trained man who sees not only the merchantable stem, but also appreciates and is able to report intelligently all features which make up the forest and its wealth, would be more useful than the untrained man, would seem to require no argument. The trained timber surveyor, then, should replace the untrained "timber-looker."

As to the prospective forester himself, he should be a man of good physique, good disposition, frugal habits, absolute honesty and thorough training. Half prepared men are of little use in forestry, especially in this beginning stage of the profession in our country. The forestry graduate in Europe goes into service under an experienced, well-trained master, just as the American graduate does in railway service. The forestry graduate in our country must plan for himself and may often have to persuade his employer of the need of any plan at all.

It is strong, well prepared men, therefore, who are wanted in forestry, but to these the profession not only assures a good living, but a life of highest usefulness and interest.

Mulford

UNIVERSITY BULLETIN

NEW SERIES. VOL. XV, NO. 29. JUNE, 1914

ANNOUNCEMENT
OF THE COURSE IN
FORESTRY
1914-1915

UNIVERSITY OF MICHIGAN
DEPARTMENT OF LITERATURE, SCIENCE AND THE ARTS

Ann Arbor
PUBLISHED BY THE UNIVERSITY
1914

Forestry Course in the University of Michigan

POLICY

In establishing a course in Forestry in the University of Michigan in 1903, the principal aims of the University were to furnish technical and general training for the professional forester, to assist in promoting the practice of forestry in the state of Michigan and to furnish information concerning forestry to those interested.

In the training of men for the profession of forestry the aim of the University is to develop strong, mature men; men with both a broad, general outlook and a thorough knowledge of the essential details of forestry. Such men are demanded by the profession, because of the great variety of conditions under which the foresters of our country must work, because of the many obstacles which beset the introduction of new ideas, and because of the unusual responsibilities which are early put upon the American forester.

In addition to the training offered professional foresters, the Forestry department is now equipped to offer instruction in forestry adapted to the needs of other professional men, such as civil engineers, architects, scientific farmers, botanists, and teachers. The department is also equipped to furnish training for men who desire to prepare themselves as forest and logging engineers, grazing specialists, forest pathologists and entomologists, as well as for timber experts in various lines of manufacturing, railway, and mining enterprises.

LENGTH OF COURSE AND ACCESSORY STUDIES

It may seem surprising to many that the course in forestry is made a five year course, while the length of the usual college course is only four years. The reasons are primarily two:

The student on leaving the forestry school in the United States is often placed in positions of unusual responsibility. While the young man who leaves a German forestry school serves several years of apprenticeship under competent, experienced men, the young American is commonly expected to work by himself, and in some cases properties worth hundreds of thousands are entrusted to his care. These conditions call for a degree of maturity, and self-reliance not usually expected of graduates in other professions.

The second reason is that the fifth year at College contributes more to the development of judgment, maturity and self-reliance than any two years of undergraduate work. That this is not merely an assumption at the University but is a real fact was clearly proved by a canvass among the forestry men now in the field. They are practically united in saying that the fifth year is necessary and that it should by all means be retained in the plan.

Regarding the comparatively large number of courses in allied subjects the following is true: The work of a forester includes a number of very distinct lines. He should know trees, their requirements as to soil, light, etc., their reproduction and growth, and finally the quality of the wood they produce. Here, then, he needs to combine a knowledge, much like the farmer, of soils, of botany, systematics, physiology and pathology; he should have mathematics to make it easy for him to measure and compute the growth of timber in the individual tree and stand of trees, and lastly he should know the technical qualities of wood and be able to judge whether a given kind of timber is suited to particular uses. A judgment of soils in forestry is of prime importance. The forester usually deals with large areas, commonly the rougher, mountainous or hilly lands, and normally the poorer soils unsuited to good farming. Here a sufficient knowledge of soils means an insight into mineralogy and geology, and acquaintance with methods of study of the soil itself. Dealing with large wild-land properties, (today often as large as an entire county in the Eastern states) he needs to be a surveyor, be able to locate lines, make topographic surveys, lay out trails and roads, and finally put everything on paper in a workmanship-like manner for report.

As caretaker of large areas of lands, in disposal of millions of feet of timber, etc., he needs to be able to prepare a contract, watch over the work and report its progress. In trespass cases it is the forester who must secure evidence and present it in court. And to keep order in all this work he should keep books and be an accountant.

In the harvest of his crop he should know the methods which make for efficiency and yet for safety to the forest. This means not only a knowledge of methods and machinery but even a personal familiarity based on a reasonable amount of experience. Year in and year out his forest is subject to injury, the fires may burn up the timber and thus destroy over three-fourths of all his property; storm, snow, ice and frost; fungi, insects, rodents and man, all join to injure and destroy. To ward off these dangers, to protect the forest is, today, the greatest task of the young forester leaving our schools. To do this task well means first of all to understand the danger, to know the insect and its ways, to know the means which are feasible or practicable to apply and the possible success attainable.

But beyond all this the forester must be more or less a leader of men, he needs to be a man of parts; not merely a narrow-minded hermit, but a man whom people like to meet, whom they can do business with and who means something to his neighbors and his community.

Then, again, the forester must love the forest, he must find pleasure and contentment in his great laboratory, the forest. The lawyer, the merchant, the blacksmith, all may live on the same street, but the forester lives and works by himself. To love his forest, his work, the life he leads, he needs to see all there is to see in his forest, to be on speaking terms with the world of living things about him, to know enough of the bird-world, the plant-world, and the many interesting features of geology and mineralogy to find interest and to hold his interest throughout life.

The forester who has to go to town to find his pleasure and recreation will, most likely, stay in town and soon cease to be a forester.

For these reasons the course in forestry at Michigan tries to bring the student in touch with at least all of the important lines of study upon which the success in the work as well as the satisfaction of the life of a forester depends. That all these courses are given by specialists in their line, is the great advantage of studying at a large University, like Michigan.

FACILITIES FOR INSTRUCTION

By referring to the University Calendar it will be seen that facilities for pursuing the fundamental and accessory studies of language, mathematics, physics, chemistry, botany, zoology, geology, mineralogy, engineering, law, etc., are amply provided.

For field work in forestry the vicinity of Ann Arbor offers excellent opportunities. Large numbers of woodlots and small forests surround the town. At very moderate cost rural street car systems take the student to a variety of hardwood and swamp forests in which all conditions from virgin woods to "slash" may be studied. Detailed results of good and bad forest work may be observed on every hand. The great pineries of the Southern Peninsula are reached by railway from Ann Arbor within a few hours. The student can cheaply and quickly reach vast areas of cut and burned over lands, stands of pine, hardwoods, tamarack and cedar, or logging camps, saw mills, woodworking plants and paper mills.

The owners of many timber properties and woodworking plants throughout the state offer special opportunities for the accommodation of students of the Forestry department while they are securing first hand information as to the methods of conducting timber work.

Special facilities for the study of forestry are supplied by the Saginaw Forest Farm, a tract of land about two miles west of the city of Ann Arbor, presented to the University by Hon. Arthur Hill, of Saginaw. The farm comprises eighty acres and is a typical example of the low, hilly land of the drift district. Its soils vary from heavy clay to sandy gravel. Its topography is varied, including slopes with various exposures, a small swamp area and a deep lake covering an area of about twelve acres.

A forest nursery and over fifty distinct forest plantations serve to illustrate the results of the various methods employed in forest nursery practice and in the making of forest plantations. They also give opportunity to carry on special experiments in the care of these many young stands of forest trees.

A special nursery for the propagation of forest trees, within ten minutes' walk of the campus, has been developed. This nursery is equipped to demonstrate certain phases of silvicultural work and the methods of commercial nursery practice from the preparation of the seed beds to the packing for shipment of the mature seedling. Quarters are provided on the grounds for the proper accommodation of students working in the nursery and for the detailed study of nursery work and investigation.

A privately owned area of fifteen hundred acres, including several watersheds which the owners desire to protect by keeping the watersheds forested, has been placed under the management of the department of Forestry. These tracts lie in the immediate vicinity of Ann Arbor and include some five hundred acres now in timber and eight hundred acres of old fields which are being reforested at the rate of over a hundred acres a year. In the management of these tracts the student has every opportunity to become familiar with protective watershed work and reforestation on a large scale.

Within fifteen minutes' walk of the campus is the University botanical garden and arboretum, a tract of about ninety acres which is being rapidly developed. This will include among many other features an arboretum of all useful forest trees that can be grown in this climate.

In the forestry laboratories students receive instruction in forest botany, timber physics, structure of woods and certain features of wood technology, as well as in forest measurement and the methods of study of the growth of timber. Working collections are provided which include specimens of cones and other forest tree fruits and seeds, specimens of commercial woods, sections of trees and herbarium specimens of the important American forest trees. There is an ample supply of microscopes, compasses, calipers, height measures and other apparatus for volume and growth studies of forests.

A greenhouse is provided with the necessary equipment for seed germination and experimental work on seedling growth. Testing machinery for strength and resistance of wood and for other studies of the physical properties of timber is provided and other special machinery is being installed.

The forestry library contains over eight hundred volumes and is steadily growing. Files containing large amounts of unbound literature are made available to the research student by a simple card index system. The principal forestry periodicals and a number of technical journals representing different phases of wood using industries are received regularly.

An unusually complete collection of photographs and thousands of lantern slides furnish necessary illustrations in the courses of study. By this means all phases of the field work of forestry and its details can be satisfactorily illustrated. The collection of slides and pictures is constantly being added to by graduates of the department who thus report new work or conditions, so that the department may keep in constant touch with forest practice as it is actually going on.

Special facilities for extensive and comprehensive field work in surveying are offered in the Bogardus Engineering Camp. By purchase and through the generosity of Colonel Charles Bogardus and his wife, Hannah Bogardus, the University in the years 1908 and 1909 acquired 1,700 acres of land having a frontage of two and three-fourth miles on the south and east shores of Douglas Lake and a frontage of one-half mile on the north shore of Burt Lake in Cheboygan Co., Michigan. Douglas Lake is a beautiful body of water about four miles long and from one to two miles wide. Burt Lake, ten miles long and five miles wide, is one of the links in the famous Inland Water Route of Michigan. This locality has a varied topography. It was first occupied by classes in surveying in 1909. The camp proper is located on the south shore of South Fishtail Bay, Douglas Lake. The tents of a part of the teaching staff, students, camp physician, and a large and comfortable office are arranged in two circular arcs on a sandy shelf a few feet above high water. The tents of other members of the teaching staff are located at the west end of the grounds on an elevated shelf. The kitchen and the mess tents are situated on the top of a hill seventy feet above and directly south of the camp. The mess is conducted by a committee made up of members from the student body and teaching staff. A driven well 120 feet deep furnishes an ample supply of pure cold water. The camp has a resident physician, telephone service, R. F. D. mail service, and a small store. The lakes afford ample opportunity for bathing, boating and fishing.

THE COURSE IN FORESTRY

Since not all students enter the forestry courses with the same amount of preparation, nor with the same plans, there is more or less modification in the program which these different classes of students follow. The most common cases are as follows:

1. Students who begin their college work at the University of Michigan and who decide at once to prepare themselves for the forestry profession should follow the program of study as outlined on page 13. These students form the majority and may expect to receive the degree of Bachelor of Science in Forestry at the end of the fourth year and the degree of Master of Science in Forestry at the end of the fifth year.

2. Students who come here from other colleges after studying one or more years but before graduating or before they receive a degree (undergraduates); and also undergraduate students at the University of Michigan who in their second or third year decide to enter the forestry courses and become professional foresters.

Students of this class will confer with the Professor of Forestry in planning their elections, after arranging their credits with the Dean of the Department of Literature, Science, and the Arts.

These students will be required to finish the work outlined in the Program of Studies, but may be allowed by the administrative officers of the Department of Literature, Science, and the Arts, with the permission of the faculty of the Forestry department, to substitute more or less of the work they have done for work required in the program. The time required to finish the work in forestry will depend, in these cases, on the amount and nature of the preparation of the student. Students who have done considerable work in the sciences naturally fare better than others.

3. Students who have graduated and received their bachelor's degree at this University, or at some other college of university rank. These graduate students should present their credentials to the Dean of the Graduate Department and apply for admission to candidacy for the degree of Master of Science in Forestry. They may expect to finish the work in two years. Unless a student of this class has pursued a considerable number of forestry studies elsewhere or has special experience that would warrant a departure from the regular scheme, he will not be allowed to elect or attend all of the forestry courses during his first year. The work to be pursued by men of this class will depend upon the nature of their preparation.

4. Men coming from colleges not of university rank will arrange their credits with the Dean of the Department of Literature, Science, and the Arts in the manner indicated for undergraduates and will then receive their standing and plan their course accordingly.

5. Students who desire to become foresters and to receive the degree of Master of Science in Forestry, but at the same time wish to specialize along certain lines such as engineering, plant diseases, insects, and wood impregnation, should apply to the Deans of the respective Departments for permission to do so after having made their plans known and having received the sanction of the faculty of Forestry in making their elections.

6. "Special students," *i. e.,* students who wish to take most or all of the forestry work without becoming candidates for the degree, will be admitted to the several courses in forestry only by special permission of the professor in charge of the courses and will generally be refused admission unless they have covered the prerequisite work.

7. Students who do not desire to become foresters but wish to take work in forestry are admitted to Courses 1, 2, 20, 22 and 24 without any preparation but require special permission to elect any other courses offered in forestry.

Candidates for the master's degree in forestry are expected in their last year's work to pass such courses as they may elect with an average standing or grade of B.

In the past a number of forestry students after four years of college attendance as undergraduates have gone into forestry work either in government or private service for a year before taking the final graduate year. This has proved of such great advantage in broadening the students' horizon and preparing them for a better understanding of the more technical phases of the profession that its encouragement has become an established policy. In the near future it is contemplated making such a year of practical field work between the fourth and fifth college years in forestry a required part of the course.

Every student is strongly urged to work at some phase of forestry or allied line during every summer vacation. This will prepare him for a better understanding of the more technical work by first seeing its application in the field.

THE UNIVERSITY YEAR

The University year is divided into two semesters, which for the year 1914-1915 are arranged as follows: first semester, from September 29, 1914, to February 5, 1915: second semester, from February 8, 1915, to June 24, 1915.

Examinations for admission to the Department of Literature, Science, and the Arts are held September 22-26, 1914, and February 4-6, 1915.

REQUIREMENTS FOR ADMISSION

To the Department of Literature, Science, and the Arts.

Applicants for admission as undergraduates must be at least sixteen years of age, and must have completed the requirements for admission as here described. These requirements are stated in units, a unit meaning the equivalent of five recitations a week in one branch of study for one year, amounting in the aggregate to not less than one hundred twenty sixty-minute hours in the clear. Two to three hours of laboratory, drawing, or shop-work will be counted as equivalent to one of recitation.

A. Fifteen units are required for admission. These fifteen units must include three units of English Composition and Literature, two units of a Foreign Language, one unit of Algebra and one of Geometry, and one unit of one of the sciences, Physics, Chemistry, Botany, or Zoology; and may include not more than three units from Group II. They must embrace two subjects of three units each from Group I. It is, however, strongly recommended that one or more studies be pursued throughout the four years of the high school course.

The subjects from which choice may be made, and the number of units which will be accepted in each subject, are as follows:

Group I

English Composition and Literature, 4 or 3 units.
Greek, 3 or 2 units.
Latin, 4, 3 or 2 units.
French, 4, 3 or 2 units.
German, 4, 3 or 2 units.
Spanish, 4, 3 or 2 units.
History, 3 or 2 units, or 1 unit.
Algebra, 2 or 1½ units, or 1 unit.
Geometry, 1½ units, or 1 unit.
Trigonometry, ½ unit.
Physics, 1 unit.
Chemistry, 1 unit.
Botany, 1 or ½ unit.
Zoology, 1 or ½ unit.
Physiology, ½ unit.
Geology, ½ unit.
Physiography, 1 or ½ unit.

Three units of science may be offered as a three-unit subject.

In order that a half unit in science may be accepted it must be supplemented by a second half unit in science. For this purpose the following groupings are suggested: (a) Botany and Zoology; (b) Zoology (or Botany) and Physiology; (c) Physiography and Geology; (d) Physiography and Botany.

Two units of mathematics and one unit of physics may be offered as a three-unit subject, in which case a second unit of science must be presented.

Group II

Agriculture, 2 units, or 1 unit.
Domestic Science, 2 units, or 1 unit.
Drawing, 1, or ½ unit.
Manual Training, 2 units, or 1 unit.
Commercial Branches, 2 units, or 1 unit.

Subjects from Group II will not be accepted for admission on examination.

B. Graduates of schools on the approved list of the North Central Association of Colleges and Secondary Schools will be admitted upon the presentation of an unqualified recommendation covering not less than fifteen units, of which at least twelve must be from Group I. Admission on this basis of recommendation may be granted also to the graduates of other especially approved schools. Applications for this privilege must be made by the superintendent or principal on special blanks which may be obtained from the Dean of the Department of Literature, Science, and the Arts.

CONDITIONAL ADMISSION

No applicant will be admitted who presents less than fifteen units. An applicant for admission, either on examination or certificate, who presents fifteen units given in the foregoing lists, but who is deficient in not more than two units in subjects there specified as mandatory may be admitted conditionally; but any condition thus incurred must be removed at one of the next two regular examinations for admission. No student who has an admission condition outstanding at the beginning of his second year of residence will be allowed to enter his classes until such condition is removed.

ADVANCED CREDIT

No advanced credit is granted for subjects studied in the high school, unless the student has taken a post-graduate high school course of at least one semester.

RULES AND REGULATIONS

For the rules governing registration, election of studies, etc., etc., see the University Calendar or the Announcement of the Department of Literature, Science, and the Arts.

Students desiring to enter as undergraduates and requiring more detailed information should refer to the Announcement of the Department of Literature, Science, and the Arts, for the requirements for admission.

All applicants for admission to graduate work in forestry must first report to the Dean of the Graduate Department, and present their credentials.

The privileges of the Graduate Department are open to graduates of the Department of Literature, Science, and the Arts of this University, and to graduates of other universities and colleges who satisfy the Dean of the Graduate Department that they are qualified to pursue with profit the advanced courses of study offered in the school.

Graduates of institutions where the undergraduate courses of study are not substantially equivalent to the course prescribed at this University, if admitted to the Graduate Department, are ordinarily required to do an additional amount of undergraduate work, or to prolong their term of residence as candidates for a higher degree.

Special students will be admitted to forestry courses only: (a) if they are college graduates; (b) as undergraduates with at least two years of college work beyond high school, if they have had very extensive experience in forest work of such character as especially fits them for undertaking the forestry courses; (c) if they have had ample preparation to pursue the studies in forestry, but are not preparing themselves for forestry as a profession. Such students must also fulfill the entrance requirements for special students of the Department of Literature, Science, and the Arts (see the Announcement of the Department of Literature, Science, and the Arts).

Copies of this bulletin, or of the general announcement of the Department of Literature, Science, and the Arts, or of the University Calendar, may be obtained by addressing the Secretary of the University. General correspondence concerning the course may be addressed to Professor Filibert Roth, Ann Arbor. Inquiries concerning entrance requirements or credit for advanced work should be addressed to Acting Dean John R. Effinger, The University, and all prospective students are urged to make arrangements concerning entrance as early as possible.

In addition to their regular University registration, all forestry students, should register with the Professor of Forestry as soon as they arrive, and should not fail to consult with him concerning their work. This is especially necessary the first year of the student's attendance.

FEES AND EXPENSES

Matriculation Fee.—Every student before entering any Department of the University is required to pay a matriculation fee. This fee, which for a citizen of Michigan is ten dollars, and for a person who comes from any other state or country, twenty-five dollars, is paid but once, and entitles the student to the privilege of permanent membership in the University.

Annual Fee.—In addition to the matriculation fee, every student is required to pay an annual fee for incidental expenses. This fee is paid the first year of residence at the University and every year of residence thereafter. Resident graduates are required to pay the same annual fee as undergraduates. The annual fee in the Department of Literature, Science and the Arts is, for Michigan students, forty-two dollars; for all others, fifty-two dollars.

Laboratory Expenses.—Students who pursue laboratory courses are required to pay for the materials and apparatus actually consumed by them. The deposits required in advance range from one to twenty dollars. The laboratory expenses for students will vary with their prudence and economy.

Diploma Fee.—The fee for the diploma given on graduation is ten dollars and the by-laws of the Board of Regents prescribe that no person shall be recommended for a degree until he has paid all his dues, including the fee for diploma.

Other Expenses.—There are no dormitories and no commons connected with the University. Students obtain board and lodging in private families for from three dollars and a half to six dollars a week. Clubs are formed in which the cost of board is from two dollars and a half to three dollars and a half per week. Room rent is from one dollar a week up for each student.

Annual Expense.—The total expense for board, room, laundry, tuition, laboratory fees, books, stationery, and miscellaneous expenses connected with the student's work, is from three hundred and fifty dollars per year up, and averages about four hundred dollars per year for students who are careful in their expenditures. This does not include clothing and other personal expenses.

DEGREE

When a student has completed enough work to secure 120 hours of credit and has done this well enough to earn 135 points, including the program of studies given on page 13, he is entitled to receive the degree of Bachelor of Science in Forestry and upon completion of the full course in forestry with proper scholarship (average B in the fifth year) or after passing a satisfactory examination he is entitled to receive the degree of Master of Science in Forestry.

PROGRAM OF STUDIES

First Year

First Semester		Second Semester	
Rhetoric 1	3 hours	Rhetoric 2	3 hours
Zoology 1	2 hours	Zoology 2	2 hours
Botany 1	2 hours	Botany 2	2 hours
Mathematics 1	4 hours	Mathematics 2	4 hours
Chemistry 1 and 1a	4 hours	Chemistry 2 and 2a	4 hours
		Forestry 20	1 hour

Second Year

First Semester		Second Semester	
Forestry 1	4 hours	Forestry 2	2 hours
Surveying 12	4 hours	Surveying 13	4 hours
Botany 13	4 hours	Botany 14	4 hours
Physics 1	4 hours	Physics 2	4 hours
		Mineralogy 1	2 hours

Third Year

First Semester		Second Semester	
Forestry 5	3 hours	Forestry 4	2 hours
Forestry 7	5 hours	Forestry 6	3 hours
Forestry 3	4 hours	Forestry 8	5 hours
Geology 1 E	3 hours	Mineralogy 9	2 hours
		Botany 26	4 hours

Summer Term: Surveying 3, eight hours at Camp Bogardus. (Elective)

Fourth Year

First Semester		Second Semester	
Forestry 9	5 hours	Forestry 10	4 hours
Forestry 13	4 hours	Forestry 14	4 hours
Botany 17	4 hours	Forestry 12*	2-4 hours
Zoology 20	3 hours	Zoology 6	3 hours
		Geology 15	3 hours

Fifth Year

First Semester		Second Semester	
Forestry 15	4 hours	Forestry 16	4 hours
Forestry 17	2 hours	Forestry 18	2 hours
Forestry 19	4 hours	Forestry 12*	2-4 hours
Forestry 11*	2-4 hours		

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* The course in Forestry Problems is required for at least one semester but may be continued through all four semesters.

A SUGGESTED SCHEDULE OF COURSES

As Worked Out March, 1914

First Year, *First Semester*

	M.	*T.*	*W.*	*Th.*	*F.*	*S.*
8	Rhet. 1	Zool. 1	Rhet. 1	Bot. 1	Rhet. 1	
9	Math 1	Math. 1		Math. 1	Math. 1	
10		Zool. Lab.		Zool. Lab.		
11	Chem 1		Chem. 1		Chem. 1	
1–4	Chem. Lab.	Bot. Lab.	Chem. Lab.	Bot. Lab.		

First Year, *Second Semester.*

	M.	*T.*	*W.*	*Th.*	*F.*	*S.*
8	Rhet. 2	Zool. 2	Rhet. 2	Bot. 2	Rhet. 2	
9	Math. 2	Math. 2	For. 20	Math. 2	Math. 2	
10		Zool. Lab.		Zool. Lab.		
11	Chem. 2		Chem. 2		Chem. 2	
1–4	Chem. Lab.	Bot. Lab.	Chem. Lab.	Bot. Lab.		

Second Year, *First Semester.*

	M.	*T.*	*W.*	*Th.*	*F.*	*S.*
8			Bot. 13		Bot. 13	
9	For. 1	For. 1		For. 1	For. 1	
10	Phys. 1	Phys. 1	Phys. 1	Phys. 1	Survey 12	
11						
1–5	Survey 12	Bot. 13 Field	Survey 12	Bot. 13 Field	Survey 12	

Second Year, *Second Semester.*

	M.	*T.*	*W.*	*Th.*	*F.*	*S.*
8			Bot. 14		Bot. 14	
9		For. 2		For. 2	Min. Lab.	
10	Phys. 2	Phys. 2	Phys. 2	Phys. 2		
11		Min. 1		Min. 1	Survey 13	
1–5	Survey 13	Bot. 14	Survey 13	Bot. 14	Survey 13	

THIRD YEAR, *First Semester.*

	M.	*T.*	*W.*	*Th.*	*F.*	*S.*
8						For. 5
9	Geol. 1 E	For. 3	Geol. 1 E		Geol. 1 E	For. 5
10	For. 5	For. 7	For. 5	For. 7	For. 5	For. 5
11						For. 5
1–5	For. 7 or For. 3	For. 7 or For. 3	For. 7 or For. 3	For. 7 or For. 3	Geol. 1 E	

THIRD YEAR, *Second Semester.*

	M.	*T.*	*W.*	*Th.*	*F.*	*S.*
8		Bot. 26	Min. 9	Bot. 26		For. 6
9	Min. 9	For. 4	Lab.	For. 4	Min. 9	For. 6
10	For. 6	For. 8	For. 6	For. 8	For. 6	For. 6
11						For. 6
1–5	Bot. 26 or For. 8	Bot. 26 or For. 8	Bot. 26 or For. 8	Bot. 26 or For. 8	For. 6	

FOURTH YEAR, *First Semester.*

	M.	*T.*	*W.*	*Th.*	*F.*	*S.*
8	For. 9	For. 9		For. 9	For. 9	For. 9
9		Bot. 17		Bot. 17		For. 9
10	For. 13	For. 13		For. 13	For. 13	For. 9
11		Zool. 20		Zool. 20	For. 11	For. 9
1–5	Bot. 17	Bot. 17	Bot. 17	Bot. 17	Zool. 20	

FOURTH YEAR, *Second Semester.*

	M.	*T.*	*W.*	*Th.*	*F.*	*S.*
8	Geol. 15		Geol. 15		Geol. 15	
9	For. 10		For. 10		For. 10	
10	For. 14	For. 14		For. 14	For. 14	
11	For. 12	Zool. 6	For. 12	Zool. 6		
1–5	For. 10			For. 10	Zool. 6	

FIFTH YEAR, *First Semester.*

	M.	*T.*	*W.*	*Th.*	*F.*	*S.*
8						
9	For. 19	For. 19	For. 17 Lab.	For. 19	For. 19	
10	For. 15	For. 15		For. 15	For. 15	
11	For. 11	For. 17		For. 17		

FIFTH YEAR, *Second Semester.*

	M.	*T.*	*W.*	*Th.*	*F.*	*S.*
8						
9	For. 16	For. 16		For. 16	For. 16	
10						
11	For. 18				For. 18	

DESCRIPTION OF COURSES

Special Work in Allied Subjects

For a complete list of courses see the University Calendar or the Announcements of the Departments of Literature, Science, and the Arts, of Engineering, and of Law, and elections of studies should be made from these official Departmental Announcements to insure the correct assignments of days, hours, rooms, etc.

BOTANY

13. Forest Botany. *Four hours,* first semester. Lectures, field and laboratory work. Lectures, *W, F,* at 8. Museum Lecture Room. Field and laboratory work, *eight hours a week.* Room 106. Mr. PIETERS.

Students will be grouped in two sections, and each student will be expected to work two half days, from 1 to 5, *M, T, W,* or *Th.* Students must arrange their sections with the instructors before filing their election blanks.

The work of this course will consist of the study of the external morphology, the identification and classification, and the biology of the trees, shrubs, and herbaceous plants of the forest societies. By the requirement of field notes and laboratory notes and drawings, students will have practice in the methods of descriptive botany and dendrology.

14. Forest Botany. Continuation of Course 13. *Four hours,* second semester. Lectures, field and laboratory work. Lectures, *W, F,* at 8. Museum Lecture Room. Field and laboratory work, *eight hours a week.* Room 106, S. W. Mr. PIETERS.

In this course there will be two sections at the same hours as in Course 13. The first half of the semester will be spent in the study of the development, structure and functions of the tissues of woody plants. The second half of the semester will resume the outdoor study of forest plants.

17. Morphology, Physiology and Classification of Fungi. *Four hours,* first semester. Lectures and quizzes, *T, Th,* at 9. Museum Lecture Room. Field and laboratory, Sec. I, *M, W,* 1-5; Sec. II, *T, Th,* 1-5. Assistant Professor KAUFFMAN.

This course is primarily for students intending to study forestry. Special attention will be paid to those fungi causing diseases of trees and decay of wood.

Students must arrange their sections with the instructor before filing their election blanks.

21. Morphology, Ecology and Classification of Plants. *Four hours,* first semester. Lectures, readings, field and laboratory work. Lectures, *M, F,* at 8. Room 207, S. W. Field and laboratory work, eight hours a week, *M, W,* 1-5. Room 106, S. W. Assistant Professor GLEASON.

The work of the course will be presented from the standpoint of the life of the plant in nature. The first month is given to classification, with field work on the local flora. The remainder of the semester is given to morphology of flowering plants, the structure of stems and leaves, and the correlation of plant structures with their functions and with the life and habits of the plant.

24. Phytogeography of North America. Lectures and assigned readings. *Two hours,* second semester. Lectures, *M, W,* at 9. Room 207, S. W. Assistant Professor GLEASON.

Beginning with a description of the vegetation of Michigan and its geographical relations, this course will next proceed to a review of the floral formations of North America. This will be followed by a study of the historical development of the flora, the influence of the glacial periods, and the modern dynamic trends of vegetation.

26. Experimental Physiology. *Four hours,* second semester. Lectures, *T, Th,* at 8. Museum Lecture Room. Laboratory work. Sec. I, *M, W,* 1-5. Sec. II, *T, Th,* 1-5. Professor NEWCOMBE.

A study of the relation of plants to their environment as manifested by the phenomena of nutrition, growth, and irritability.

Students must arrange their sections with the instructor before filing their election blanks.

ZOOLOGY

20. Economic Zoology. *Three hours,* first semester, two class meetings. *T, Th,* at 11. Museum Lecture Room. Laboratory or demonstration period, *F,* 1-4. Room 301, S. W. Assistant Professor HEGNER and Mr. SINK.

The aim of this course is to give a general survey of the animal kingdom by means of lectures, a text-book and laboratory demonstrations, emphasizing those groups that are of special economic importance. The first part of the semester will be devoted to the study of insects. This will be followed by a consideration of other groups of animals, particularly the protozoa, the parasitic worms, the fishes, birds and mammals.

6. Forest Entomology. *Three hours,* second semester. Lectures, *T, Th,* at 11. Museum Lecture Room. One laboratory or field period, *F,* 1-4. Room 301, S. W. Assistant Professor HEGNER and Mr. SINK.

A course in the habits, life histories and structure of insects with special reference to those species affecting forest and shade treees.

7. Advanced Entomology. A course intended for those who have taken an elementary course in Entomology and wish to undertake more advanced work for the purpose of specializing in some particular phase of the subject. It may be elected for *two hours, three hours, four hours, five hours,* or *six hours.* The course will necessitate consultation, readings, laboratory and field work and written reports. The hours are to be arranged with the instructor, who should be consulted before registering. Assistant Professor HEGNER.

LANDSCAPE DESIGN

Students desiring special training as city foresters, may arrange for a combined course in Forestry and Landscape Design. Such students should confer with the heads of the Departments of Forestry and Landscape Design before electing their work.

The following courses in Landscape Design are especially adapted to foresters expecting to take up city forestry work.

1. Introduction to the Study of Landscape Design. Lectures, collateral reading, and reports. *Three hours,* first semester. Professor TEALDI and Mr. ———.

Course 1 is designed to give a general knowledge of the variety of problems to be met with in the practice of landscape gardening. It is not intended as a technical course, such as a course in construction or design; these subjects are treated in Courses 10 to 17. The general problems are treated separately, and special stress is laid upon the subject of good taste and common sense in all problems, from the simple arrangement of the city yard and window box to the laying out of a country estate. The lectures are illustrated by the use of the stereopticon.

3. Study of Materials for Planting Design. Trees and Shrubs. Lectures, reports, planting plans, and field work. *Three hours,* first semester. Professor TEALDI.

Course 3 is intended tomake the student familiar with the shrubs and the trees generally used in landscape gardening. It is not intended as a course in botany, courses in botany and ecology being prerequisite to this course. The æsthetic values of plants are to be studied,—their shape, size, habits, favorite habitat, their autumn coloring both of leaves and fruit, and their general aspects in autumn and winter. One field trip a week is taken, and a report of the trip is required. The lectures are illustrated by the use of the stereopticon.

4. Study of Material for Planting Design: Trees, Shrubs, and Perennials. Lectures, planting plans, reports, and field work. *Three hours,* second semester. Professor TEALDI.

Course 4 is a continuation of Course 3. The trees and shrubs are studied in relation to their flowering and leafing characteristics and their ornamental values in spring and summer. Perennials are studied also along the same lines. The lectures are illustrated by the use of the stereopticon.

5. Civic Improvement. *Three hours,* second semester. Professor TEALDI.

This course deals with city layouts; arrangement of streets and their development; parks and squares with their development and maintenance; ornamental planting of trees and shrubs for city property; residence subdivision; Civic Associations.

GEOLOGY

1E. Introduction to Geology, for Engineering and Forestry Students. A course adapted to the needs of students in these departments and not open to others except by special permission. *Three hours.* Lectures *M, W, F* at 9; Laboratory *F* 1-4. Professors HOBBS and CASE, Assistant Professor SCOTT and Assistant.

2. Historical Geology. *Five hours,* either semester. Lectures, *M, T, W, Th, F,* at 11. Laboratory work, *T,* 3-5. Professor CASE and assistant.

An outline history of the development of the continent and of the appearance and extinction of plants and animals, from the records in the rocks.

12. Elementary Meteorology. This course is designed to follow the course in physiography and is an elementary treatment of the dynamics of the atmosphere. In it will be discussed the properties and movements of the atmosphere, weather and its variations, together with some account of weather prediction. *T, Th,* at 10. *Two hours.*. Russell Seminary Room. Laboratory *one hour as arranged.* Assistant Professor SCOTT.

15. Soil Geology. *Three hours,* second semester. *M, W, F,* at 8. Geological Laboratory. Dr. COOK.

A comprehensive survey of the subject, including the origin of soils, their physical and chemical constitution, the influence of climate on soil fertility, irrigation and drainage, tillage, fertilizers, etc., and a consideration of the regolith of the United States in relation to geologic, physiographic, and climatic factors.

Prerequisites, Geology 1 and Mineralogy 1 and 9.

MINERALOGY AND PETROGRAPHY

1. Elements of Mineralogy. Lectures and laboratory work. *Two hours,* either semester. Lectures, *T, Th,* at 11. Laboratory work, *two hours a week, to be arranged.* Mineralogical Lecture Room, T. H. Professor KRAUS, Assistant Professor HUNT, Mr. CLARK, and assistants.

This course includes the elements of crystallography, physical and chemical properties, occurrence, uses, and determination of the more common minerals. For this course a knowledge of elementary inorganic chemistry is necessary.

9. Lithology. Lectures and Laboratory work. *Two hours,* either semester. Lectures, *M, F,* at 9. Laboratory work, *two hours a week, to be arranged.* Mr. CLARK.

The lectures include, aside from a review of the rock-forming minerals, a discussion of the origin, modes of occurrence, alterations, methods of determination, and uses of the more important rocks. In the laboratory the student is required to determine by means of the macro-physical properties a large number of rock specimens. Field excursions will also be made in order to acquire facility in the rapid determination of rocks in the field. Prerequisites, Mineralogy 1 and Geology 1.

ENGINEERING

12. Surveying. Drawing. Lectures. Text-books. Recitations. Field Practice. *Four hours.* Given first semester.

Linear Measurements. Field Notes. Verniers. Angle Reading. Traverse Surveying. Computing Areas. Platting. Leveling. Profile. Grade Line. Vertical Curves. Straight Lines. Staking out Buildings. Setting Grade Stakes.

For second year students in Forestry and Landscape Design. Assistant Professor RASCHBACHER and Mr. BRODIE.

13. Surveying. Field Work. Drawing. Mapping. *Four hours.* Given second semester.

Surveys with Stadia, Plane Table and Camera.

For students in Forestry and Landscape Design. Assistant Professor RASCHBACHER and Mr. BRODIE.

3. Surveying. Summer Camp. *Eight hours.* Camp fee, $10.00; Summer Session fee, $20.00.

This course is given at the Engineering Camp of the University of Michigan, on Douglas Lake, six miles east of Pellston, Cheboygan County, Michigan.

The course includes azimuth work; compass, plane table and stadia surveys; railroad and land surveys; triangulation and hydrographic surveys; cross-section work, and soundings.

Particular attention is also given to the care and adjustment of instruments.

Office work includes the making of maps and diagrams and the keeping of permanent records of work performed.

The students are given instruction in camp maintenance and in many things which relate to the welfare of those who spend their lives in the open.

This course is open only to those who have had Courses 1 and 2 or 12 and 13 in Surveying in the University of Michigan, except by special permission.

The work is in charge of Professor JOHNSTON, Assistant Professors MERRICK, ATWELL, Mr. BRODIE, Mr. BAILEY and assistants.

Students unable to arrange their hours otherwise, will also be allowed to elect Surveying 1 and 2 to prepare for the summer work at Camp Bogardus.

24. Mechanical Engineering. Prime Movers. *Three hours,* first semester. Lectures, *M, W, F,* at 9. Professor ANDERSON.

This course is offered primarily for forestry students. It embraces a study of the steam engine, gas engine, and water turbine, together with the study of the various methods of transmitting the power from these prime movers. The subject is covered in a popular way, and, in addition attention is given to the operation of the various machines.

This course should be preceded by Courses 1 and 2 in Physics.

For other courses see the annual announcement of the Department of Engineering.

First Aid to the Injured.

One hour, second semester. Lecture *W,* at 1. Laboratory *W,* 2-4. Addition Homoeopathic Hospital. Dr. STOUFFER.

This course is given under the auspices of the Engineering Department.

LAW

1. Contracts. Operation, interpretation and discharge of contracts. Text-book and cases. *Three hours,* second semester. Professor KNOWLTON.
2. Property II. Tenures, estates, seisin, statute of uses, fixtures, emblements, waste, natural rights, profits, easements, and covenants, running with the land. Cases. *Four hours,* second semester. Professor AIGLER.
3. Property III. Public rights, franchises, landlord and tenant, title to real estate by original acquisition and lapse of easements and profits, estoppel by deed, and dedication. Cases. *Four hours,* first semester. Professor AIGLER.

For other courses see the annual announcement of the Department of Law.

FORESTRY

The courses in Forestry are intended primarily for the regular forestry students, but are open to all students of the University, if properly prepared to take them.

The following courses require no special preparation: 1, 2, 20, 22, and 24. Anyone, not a student of forestry, desiring to take any of the other courses must secure permission of the professor in charge.

1. Introduction to Forestry.

A general presentation of the subject, its history, objects, methods, as well as its economic importance.

Open to all students.

Four hours credit, first semester. Lectures. Professor ROTH and Mr. POTTINGER.

2. Woodlots and Forest Parks.

Importance to individuals and communities. Value from economic, æsthetic, and physical viewpoints. Distribution and extent in the United States. Present condition. Methods of locating, establishing, handling, exploiting, and reproducing or perpetuating.

Open to all students. No prerequisites.

Two hours credit, second semester. Two lectures and an occasional field trip. Professor SPONSLER.

3. Timber.

Structure and identification of woods used for timber. Study of mechanical properties (strength and resistance) by actual tests. Methods of seasoning and preservative treatment of woods.

Prerequisites, Physics 1, Botany 13 and 14.

Four hours credit, first semester. One lecture and two laboratory periods of four hours each. Assistant Professor YOUNG.

4. Forest Improvements.

Planning, locating, and constructing headquarter stations and buildings, forest roads, trails, telephone lines, lookout stations, camps and other permanent improvements; locating and developing systems of improvements; costs of construction and maintenance. The course considers improvements for administration and protection rather than for logging or other exploitation.

Prerequisites, Forestry 7 and Surveying 12.

Two hours credit, second semester. Two lectures and field work. Assistant Professor LOVEJOY.

5. Silvics.

Life of the tree, its habits and behavior in the woods. Includes structure and functions of the roots, stem, leaves and fruit, the effects of soil, climate, light, and other factors upon the tree and the forest in general and upon the important timber trees and forests in definite regions.

Prerequisites, Botany 13 and 14 and Forestry 1.

Three hours credit, first semester. Three lectures and one laboratory or field period. Professor SPONSLER.

6. Silvics.

Continuation of Course 5.

Prerequisite, Forestry 5. Botany 26 must precede or accompany the course.

Three hours credit, second semester. Three lectures and one laboratory or field period. Professor SPONSLER.

7. Forest Mensuration.

Timber estimating and scaling; methods of surveying and mapping of forest lands; methods used in forest investigations for measuring volumes of single trees and entire stands of timber; study of rate of growth of single trees and yield in volume of entire stand.

Prerequisites, Surveying 12 and 13, Botany 13 and 14, Mathematics 1 and 2.

Five hours credit, first semester. Two lectures and two laboratory or field periods. Mr. POTTINGER.

8. Forest Mensuration.

Continuation of Course 7.

Prerequisite, Forestry 7.

Five hours credit, second semester. Two lectures and two field periods. Mr. POTTINGER.

9. Silviculture.

Natural reproduction of the forest, or silvicultural systems of treatment. Methods used in care of the forest-improvement cuts, thinnings, underplanting, etc. Application of methods of reproduction and care to conditions in United States and Canada. Timber marking.

Prerequisites, Forestry 6, Botany 26. Geology 15 must precede or accompany this course.

Five hours credit, first semester. Four lectures and one field period. Assistant Professor YOUNG and Mr. POTTINGER.

10. Silviculture.

Artificial reproduction of the forest. Methods of direct seeding. Raising trees in the nursery. Methods of planting trees in the field. Actual practice in nursery and planting work.

Four hours credit, second semester. Three lectures and one field period of four hours. Assistant Professor YOUNG and Mr. POTTINGER.

11. Forestry Problems.

Methods of attack and solution of problems. About eight lectures during the semester. Individual work on problems with any member of the Forestry Faculty.

Open only to fourth and fifth year students. *Two, three,* or *four hours credit,* first semester. Professor SPONSLER in charge.

12. Forestry Problems.
    Same as Course 11, or continuation of Course 11.
    Two, three, or four hours credit, second semester.
13. Forest Utilization.
    Methods of realizing upon forest resources. Uses of timber, points of production and market. Methods of manufacture, costs and values. Minor forest products. Logging and sawmilling. Stumpage valuation. Timber sale contracts and sale administration. Miscellaneous forest uses.
    Prerequisites, Surveying 12 and 13 and Forestry 1.
    Four hours credit, first semester. Lectures and field work. Assistant Professor LOVEJOY.
14. Forest Utilization.
    Continuation of Course 13.
    Prerequisite, Forestry 13.
    Four hours credit, second semester. Assistant Professor LOVEJOY.
15. Forest Management.
    General forest surveys and preparation of working plans; administration and regulation of the field and office work in the care of a large tract of timber and the methods of calculation involved in judging the value of forests and forest operations.
    Prerequisites, Forestry 7, 8, 9, 10, 13, and 14.
    Four hours credit, first semester. Lectures. Professor ROTH.
16. Forest Management.
    Continuation of Course 15.
    Prerequisites the same as for Course 15 and including Forestry 15.
    Four hours credit, second semester. Lectures. Professor ROTH and Mr. POTTINGER.
17. Dendrology.
    Important forest trees, classification, relation to economic phases and geographic features of the region; forest types.
    Prerequisites, Botany 13 and 14; Forestry 1, 5, and 6.
    Three hours credit, first semester. Two lectures and two hours of laboratory work. Professor SPONSLER.
18. National Forest Administration.
    History of the public land policy of the U. S. Public land laws and their administration. Land classification. Development of the National Forest policy. Organization and work of the U. S. Forest Service. Detail of National Forest Administration.
    Prerequisite, Forestry 15.
    Two hours credit, second semester. Lectures. Assistant Professor LOVEJOY.
19. Forest Protection.
    Enemies of the forest as they affect the work of the forester. Forest laws, trespass and trespass procedure. Occurrence, prevention and suppression of forest fires. Rating of protection

costs to hazards and values. Planning and operating fire preventing and fire fighting systems. Preventive and protective measures in attack by insects and fungi. Meteorological and other damages.

Prerequisites, Forestry 4, 9 and 10, Botany 17, Zoology 6.

Four hours credit, first semester. Lectures. Assistant Professor LOVEJOY.

20. Conservation with Special Reference to the Forest Resources of the United States.

Extent and location of our forests; standing supplies of timber; the cut of timber and its distribution; forest influences; general methods of handling forests; forest history and policy in the United States and abroad.

The treatment of the subject in general and from the standpoint of public economy.

Open to all students.

One hour credit, second semester. Lectures. Professor ROTH.

22. Forestry for Civil Engineers.

Economic importance of forestry. Relation of forests to precipitation and stream-flow with especial reference to power and storage reservoirs and irrigation projects. Methods of planting for reservoir protection, snowbreaks and windbreaks. Identification, characteristics, methods of storage and seasoning of timbers used in construction. Preservative treatment of such timbers. Special surveys of timber holdings. Methods of securing rights of way and easements across forested lands. Fire protection.

No prerequisites.

Open to all students.

Two hours credit, second semester. Two lectures, hours to be arranged. Assistant Professor YOUNG.

24. Forestry for Teachers.

The forester's work and problems he has to solve. Economic importance of forestry. History of forestry in the United States and abroad. Our timber resources and their distribution. Factors affecting tree-growth. Influences of forest upon climate, stream-flow, and erosion. How the forest is reproduced and cared for. Method of identifying common trees. Tree species desirable for different purposes. Forestry literature.

Non-technical treatment of subject.

Open to all students. No prerequisites.

Two hours credit, second semester. Two lectures, hours to be arranged. Assistant Professor YOUNG.

WINTER CONFERENCE

The frequent return to the University for reunion and conference, of many of the graduates who have been practicing their profession in different regions, has led to the development of a plan to focus and make more generally available the extremely valuable experience possessed by the returning alumni. Under this plan, the graduates working in the field are urged to arrange their affairs so as to make their assembling at the University possible at a given time during the winter. Those who are unable to attend are requested to send in reports of new methods and results, papers dealing with difficulties developed by current practice, and problems on which they are working and in which it is possible that the experiences brought out by the conference may prove of benefit. The problems and questions developed during the year or coming up during the conference, which cannot be decided or answered at once, will be taken up by the department for research.

It is believed that this plan of holding conferences will prove of great benefit to those in attendance, as well as serving to keep the department in the closest touch with the extraordinary variety of difficulties which necessarily develop in the practice of an old profession under new conditions. Such meetings should also assist materially in keeping the class-room work accurately focused on the field requirements of the profession, in conformity with the policy of the department.

Men in the field are encouraged at all times to refer their problems and the results of their work to the department, which, keeping as it does, in touch with its graduates, is often able to render valuable service in acting as a clearing house for information concerning current forest practice.

QUALIFICATIONS OF THE FORESTER

In training the forester needs all that it is possible for him to secure. A good training will include a very thorough and comprehensive technical education together with a wide experience in forest work, covering as great a range as possible. Half-prepared men are of little use in forestry, especially in this beginning stage in America. As to the prospective forester himself, he should be a man of good physique, good disposition, frugal habits and absolute honesty.

OPENING FOR FORESTERS

Because forestry is in its infancy in America, it is not easy to forecast its future. It is certain, however, that the number of foresters employed in America has increased very rapidly and there is today not a single competent forester in the United States who is not employed in his profession. There seems no valid reason to anticipate that this condition will be materially changed for many years.

Of the several hundred million acres of woodland in the United States, the greater part is today culled, cut, and burned over. With a most extraordinary and constantly increasing demand for wood in all its forms, today 90 million people are dependent for their timber on what is comparatively a remnant of the original supply. It seems certain that no change in these conditions is likely to occur before serious disturbances in our economic conditions are set up, due to a shortage in the timber supply. It will require the services of many thousand trained men to start the work of protecting and improving our forests, and it will require the continued efforts for all time of many thousands more to carry on the work successfully.

Fortunately it may be said that a general awakening to the needs of better treatment of woodlands has taken place. All classes of people are beginning to realize a few simple and important truths: that not all land is plowland; that it is poor business to destroy a forest and throw away the land when with a little care it might be logged and still leave a valuable forest for future use; that it is wasteful to leave the large areas of non-agricultural lands in a non-productive waste-land condition.

As a consequence of this awakening, guided and promoted especially by the intelligent and energetic efforts of the United States Forest Service, hundreds of forest owners have of late called for the advice and assistance of men trained in the right use and care of the woods. That this demand for help will increase is certain, and it is reasonable even to believe that quite a rapid increase in this demand may be looked for. As it is, there are hundreds of estates now in charge of untrained men, who are unable to provide more than mere patrol service, while the service of a trained man would not cost any more and would certainly yield larger returns.

Besides the owners of estates whose lands are held for various reasons, there are many persons engaged in dealing in timber land for the purpose of direct exploitation (lumbering) or for speculation, who employ well paid men as "timber-lookers," "estimators," or "cruisers," to make timber or forest surveys, usually with a view to determining the present market value of the woods. That a trained man who sees not only the merchantable stem, but also appreciates and is able to report intelligently all features which make up the forest and its wealth, would be more useful than the untrained man, would seem to require no argument. The trained timber surveyor, then, should replace the untrained "timber-looker."

A number of railway companies, finding their available supply of tie and construction timber becoming short, have within the last few years entered upon an investigation of the possibilities of the practice of forestry on their lands. Several have already made great investments and employ numbers of foresters, and more will doubtless be forced into it in the near future. The production of paper pulp in quantities has led to great investments in plants and mills, and this is not warranted unless there is a very long supply of the right timber in sight. Several large paper companies in the United States and Canada already employ foresters to look after their interests with respect to a continued supply of timber.

Within the last few years, many banking houses have placed "timber bonds" on the market. The value of such bonds depends on many factors affecting the quality, quantity, accessibility, safety, and investment value of the timber-holding on which the bonds are based, and the investigation of the forest in order to determine these factors is essentially work for the trained forest expert.

The enormous losses from forest fires and the very considerable losses from the attacks of insects and fungi which our great forest tracts have sustained in late years, together with the rapid increase in timber values, have led many owners of timber to invest in elaborate and expensive systems of patrol and in campaigns of education. The direction of such campaigns and the laying out and administration of such protective systems call for expert assistance which the forester should be prepared to furnish.

The demand for properly qualified instructors in forestry has for several years been greater than the supply.

More than twenty States have entered upon a more or less well-defined policy of encouraging forestry, and a few States own and administer their own forest reserves. A number of foresters are employed in such state work, and it is certain that many more will be required if State forestry is to take its proper place in public economy.

The United States Government, through the Forest Service, is now administering nearly two hundred million acres of lands in the National Forests and is employing several thousand foresters of different grades. An increasing number of these are trained men and many thousand more men will be urgently needed before the National Forests can be adequately protected, developed, and administered.

For many of the more self-reliant, capable men the above described opportunities for positions with large owners, organizations or the State can not and should not be a special inducement. For this class of men the forest conditions in the United States offer unlimited opportunity. Any man of this kind if he will put twenty years of persistent effort into working for himself should be able to own his own forest and be his own forester.

There seems no reason to doubt, then, that for the strong, well-prepared man the profession of forestry assures not only a good living but also a clean and healthful life of the highest usefulness and interest.

DIRECTORY OF MEN NOW IN THE FIELD WHO HAVE ATTENDED THE UNIVERSITY OF MICHIGAN, TAKING THE COURSE IN FORESTRY

Alden, Whiting, M.S.F. 1911, Calgary, Alta., Forester to C. P. R.

Baker, Kelts C., M.S.F. 1912, American Rubber Co. of N. Y., stationed at Sumatra, East Indies.

Barrus, George L., M.S.F. 1910, Albany, N. Y., State Forestry Service.

Bedford, John M., M.S.F. 1910, Klamath Falls, Ore., Forester, U. S. Indian Service.

Bliss, Z. E., A.B. 1905, Houston, Tex. Nursery Work.

Blumer, J. C., 1905, Saskatoon, Can.

Boerker, R. H., M.S.F. 1911, Red Bluff, Cal., Forest Assistant, Lassen National Forest.

Bradfield, W. E., M.S.F. 1905, Albuquerque, N. M.

Bravo, Hylton L., A.B., Lumber Business, Toledo, O.

Brower, Asa L., M.S.F. 1908, Kamas, Utah, Forest Service, Nursery Work.

Brown, F. B. H., M.A. 1904, Instructor in Forest Botany, Ohio State University, Columbus, Ohio.

Bruner, E. M., M.S.F. 1912, Washington, D. C., Appalachian Forest Service.

Chenay, H. F., in private work, Detroit, Mich.

Clapp, Earle H., A.B. 1905, Washington, D. C., Forest Inspector in Silviculture.

Clark, Harold C., M.S.F. 1910, with Society for Protection of N. H. Forests, Boston, Mass.

Clark, F. G., A.B. 1911, Missoula, Mont., Deputy Supervisor, Missoula National Forest.

Clifford, E. C., A.B. (Maine) 1906. Sheridan, Mont., Deputy Forest Supervisor, Madison National Forest.

Cobbs, J. L., M.S.F. 1909, with Kaul Lumber Co., Birmingham, Alabama.

Cook, Irwin W., M.S.F. 1910, Salmon, Idaho, Forest Assistant, Salmon National Forest.

Coulson, E. H., M.S.F. 1912, Nevada City, Cal., Forest Assistant on Tahoe National Forest.

Craig, Robert, Jr., M.S.F. 1910, Eugene, Oregon, Forest Service, Siuslaw National Forest.

Cronk, C. P., M.S.F. 1912, Forester, Jas. D. Lacey Co., Portland, Ore.

Daniels, L. E., B.S. 1911, Cambridge, Mass.

De Nancrede, H. W., A.B. 1908, Newport, Wash., Forest Assistant, Kaniksu National Forest.

Dickson, J. R., M.S.F. 1908, Canadian Forestry Service, Ottawa, Canada.

Drake, W. M., M.S.F. 1906, Flagstaff, Arizona, Forest Supervisor, Coconino National Forest.

Duppert, William J., M.S.F. 1910, Private Nursery, Davenport, Iowa.

Dwindelle J. K., Thompson Falls, Mont., Deputy Forest Supervisor, Cabinet National Forest.

Duthie, G. A., M.S.F. 1909, Laramie, Wyo., Forest Supervisor, Medicine Bow National Forest.

Evans, O. M., A.B., 1909, Weaverville, Cal., Forest Assistant, Trinity National Forest.

Everett, H., M.S.F. 1904, U. S. Forest Service, later in the Philippine Forest Service where he lost his life in June, 1908.

Farquhar, H. H., 1909, Missoula, Mont., in charge of planting in the district office.

Frothingham, Earle H., M.S.F. 1906, Washington, D. C., Silvics work, Forest Service.

Gardner, Earle W., A.B. 1912, Libby, Mont., Kootenai National Forest.

Goetz, C. H., B.S. (Mich. Agri. College) 1908, Colorado Springs, Colorado. Professor of Forestry.

Gooch, W. L., A.B. 1912, Forest Assistant Coeur d'Alène, Idaho.

Goode, Richard H., M.S.F. 1911, Lumber Broker, Boston, Mass.

Gould, Clark W., A.B. 1910, Washington, D. C., Statistician, U. S. Forest Service, Branch of Products.

Graff, Herbert, M.S.F. 1908, McCall, Idaho, Forest Supervisor, Idaho National Forest.

Greene, Geo. R., M.S.F. 1911, Instructor in Forestry, Penn State College, State College, Pa.

Green, Howard A., M.S.F. 1911, Pontiac, Mich.

Grossman, H. G. A., M.S.F. 1912, Priest River, Idaho, Forest Assistant Priest River National Forest.

Gutches, G. A., M.S.F. 1909, Forest Inspector, Canadian Forest Service, Prince Albert, Saskatchewan, Canada.

Han, Ngan, M.S.F. 1911, Department of Agriculture and Forestry, Peking, China.

Hastings, Wilmot J., M.S.F. 1910, Portland, Ore., Deputy Forest Supervisor, Columbia National Forest.

Headsten, Edward W., M.S.F. 1909, Republic, Wash., Forest Assistant, Colville National Forest.

Hill, C. L., M.S.F. 1905, Northfork, Cal., Forest Assistant, Sierra National Forest.

Holroyd, H. B., B.S. (Kansas Agri. College), 1905, Muncie, Ind., Investigator of utilization of wood waste.

Hopkins, A.S., M.S.F. 1909, N. Y. State Forest Service.

Hopson, R. E., A.B. 1910, In charge of Forest in Adirondacks, Old Forge, N. Y.

Janes, L. L., Harrison, Ark., Forest Examiner, Ozark National Forest.

Jennings, C. M., Milwaukee, Wis.

Jotter, E. V., M.S.F. 1909, Weaverville, Cal., Forest Examiner, Trinity National Forest.

Kempfer, W. H., A.B. 1906, Madison, Wis., U. S. Forest Service, Branch of Products, in charge of purchases.

Keplinger, Peter, M.S.F. 1908, Wagon Wheel Gap, Colo., Forest Assistant, Wagon Wheel Gap Experimental Station.

King, Rex, A.B. 1909, Forest Examiner, Albuquerque, N. Mex.

Knapp, M. D., M.S.F. 1912, Instructor in Forestry, Los Banos, Philippines.

Koehler, Arthur, Madison, Wis., Xylotomist, U. S. Forest Service.

Kotok, E. I., M.S.F. 1911, Sisson, Cal., Forest Assistant, Shasta National Forest.

Kümmel, J. F., M.S.F. 1907, Beck Bldg., Portland, Ore., in charge of planting district No. 6, Forest Service.

Larsen, Louis T., M.S.F. 1910, Sonora, Cal., Forest Assistant, Stanislaus National Forest.

Leavitt, Clyde, M.S.F. 1904, Ottawa, Can., Forester to Canadian Conservation Commission.

Lindsay, H. F., M.S.F. 1912, Missoula, Mont., Forest Assistant, Bitterroot National Forest.

Lovejoy, P. S., Ann Arbor, Mich., Assistant Professor of Forestry, University of Michigan.

Lyons, George W., M.S.F. 1911, Hot Springs, Cal., Deputy Supervisor on Segnoia-Kern Forest.

McCarthy, Edwin F., M.S.F. 1911, Syracuse, N. Y., Assistant Professor of Forestry, Syracuse University.

McDuff, N. F., A.B. 1907, Grant's Pass, Ore., Forest Supervisor, Siskiyou National Forest.

Maris, Harry Boyd, A.B. 1909, Jackson, Wyo., Forest Examiner, Teton National Forest.

Mathews, D. M., M.S.F. 1909, Bureau of Forestry, Manila, P. I., Philippine Forest Service, Professor of Forestry at Manila, P. I.

Matheson, Forest D., M.S.F. 1911, Elkhorn, Wis.

Metcalf, Woodbridge, M.S.F., 1912, Montreal, Quebec, Assistant Forester, C. P. R.

Moody, F. B., M.S.F. 1906. Professor of Forestry, Cornell University, Ithaca, N. Y.

Morrill, F. W., A.B. 1911, private forestry work in Massachusetts.

Morris, William W., M.S.F. 1909, Coeur de'Alène, Idaho, Deputy Forest Supervisor, Coeur d'Alène National Forest.

Morrison, J. R., M.S.F. 1911, Denver, Colo., Forest Assistant, U. S. Forest Service.

Mosher, Frank J., M.S.F. 1911, Livingston, Montana, Forest Assistant, Absaroka National Forest.

Morse, Chester B., M.S.F. 1909, St. Anthony, Idaho, Forest Supervisor, Targhee National Forest.

Munns, E. N., A.B. 1911, San Bernardino, Calif., Forest Assistant Angeles National Forest.

Nellis, Jesse C., A.B. 1911, Washington, D.C., Forest Assistant in Forest Products, U. S. Forest Service.

Noy, E. D., Mishawaka, Ind. Private Forestry Work.

Payne, I. W., 1911, in Private work, Boston, Mass.

Peavey, Geo. W., M.S.F. 1904, Corvallis, Ore., Professor of Forestry, Oregon State College.

Peck, Allen S., Ph.B. 1905, Forest Inspector U. S. Forest Service, Washington, D. C.

Phillips, F. J., M.S.F. 1906, Lincoln, Neb., Professor of Forestry in the University of Nebraska, at time of death, 1911.

Pierce, Roy G., M.S.F., 1907, 6 Beacon St., Boston, Mass., with State Forester.

Pottinger, J. H., A.B. 1912, Instructor in Forestry, University of Michigan, Ann Arbor, Mich.

Pound, E. H., Am. Rubber Co., New York. Stationed at Sumatra, East Indies.

Preston, J. F., A.B. 1907, Hammond Blk., Missoula, Mont., U. S. Forest Service, Assistant District Forester, in charge of operations at district office.

Randles, Quincy, M.S.F. 1911, Albuquerque, N. M., District Lumberman, District No. 3, U. S. Forest Service.

Ransom, Webster H., M.S.F. 1910, Libby, Mont., Forest Examiner, Kootenai National Forest.

Reed, H. R., A.B. 1912, Bozeman, Montana.

Reynolds, D. B., A.B. 1909, Grant's Pass, Ore., Deputy Forest Supervisor, Siskiyou National Forest.

Sackett, H. S., A.B. 1906, Forest Products Co., New Orleans, La.

Saxton, James B., M.S.F. 1910, Fort Simcoe, Wash., Forester, U. S. Indian Service.

Shepard, E. C., M.S.F. 1911, Logan, Utah, Forest Examiner, Cache National Forest.

Scherer, N. W., B.S. 1912, Assistant Professor of Forestry, Ohio State University, Columbus, Ohio.

Skeels, Dorr, 1904-'05, Professor of Forestry, Univ. of Montana, Missoula.

Smith, H. R., Collins, Mo., with Okatoma Saw Mill Co.

Smith, R. J., B.S. University of Maine, M.S.F. 1912, Coeur d'Alene National Forest.

Smith, C. Stowell, A.B. 1905, First National Bank Bldg., San Francisco, Cal., Assistant District Forester, U. S. Forest Service.

Smith, Seward D., M.S.F. 1910, Forest Examiner, Denver, Colorado, in charge of planting.

Spaulding, T. C., M.S.F. 1909, Chouteau, Montana. Forest Supervisor, Lewis & Clark National Forest.

Sponsler, O. L., A.B. 1910, A.M. University of Nebraska, Ann Arbor, Mich., Junior Professor of Forestry, University of Michigan.

St. Clair, R. C., M.S.F. 1912, Calgary, Alta., with C. P. R.

Starker, C. J., B.S., Beck Bldg., Portland, Ore., Forest Assistant, U. S. Forest Service.

Stephen, John W., M.S.F. 1907; 2191 S. Salina St., Syracuse, N. Y., Assistant Professor of Forestry, Syracuse University.

Stewart, Sidney S., M.S.F. 1909, Deputy Forest Supervisor, Salmon National Forest, Salmon, Idaho.

Stickney, Mallory N., A.B. 1906, Newport, Wash., Forest Supervisor, Kaniksu National Forest.

Stock, J. Fred, Laramie, Wyo. Forest Ranger, Medicine Bow National Forest.

Stout, H. G., M.S.F. 1910, Iloilo, Iloilo, P. I. Philippine Islands Forest Service.

Stretch, R. A., A.B. 1907, Forest Supervisor, Ogden, Utah.

Strothman Sylvester H., M.S.F. 1910, Willows, Cal., Forest Examiner, California National Forest.

Sweeney, M. J., M.S.F. 1912, Forest Assistant, Black Hills National Forest, Deadwood ,So. Dakota.

Warner, J. D., M.S.F. 1905, Livingston, Mont., Forest Supervisor, Absaroka National Forest.

Wegner, Frank A., M.S.F. 1912, Calgary, Alta., Forestry Branch, C. P. R.

West, H. E., M.S.F. 1912, Forest Assistant, Bozeman, Montana.

Wetmore, F. W., A.B. 1908, Real Estate Co. of Mexico, 10 Grante, Mexico, Mex., Consulting Forester.

White, W. W., M.S.F. 1906, Missoula, Mont., Forest Supervisor, Bitterroot National Forest.

Whitney, C. N., A.B. 1907, Anaconda, Mont., Forest Examiner, Deerlodge National Forest.

Williams, W. H. E., A.B. 1912, Norway, Mich.

Winegar, B. M., 1910, with C. P. Ry., Montreal, Canada.

Wulff, V. J., A.B. 1908, Sonora, Cal., Forest Assistant, Stanislaus National Forest.

Young, Leigh J., M.S.F. 1911, Ann Arbor, Mich., Assistant Professor of Forestry, University of Michigan.

Zavitz, E. J., M.S.F. 1905, Guelph, Ontario, Can., Provincial Forester and Professor of Forestry at Ontario Agricultural College.

IMPORTANT NOTICE.

Students entering the Department of Literature, Science, and the Arts, with the intention of taking the course in Forestry should inform the Committee on Elections of that intention, in order that their election of studies may be made in acordance with the prescribed program given on page 13.

All Forestry students entering the University with advanced standing and those transferring from some other course to that of Forestry, should consult the faculty of the department of Forestry before making their elections.

The course in Forestry is prescribed throughout, and must be taken in the order given on page 13. No deviations may be made from this order except by permission of the Professor of Forestry.

Before making elections each semester, all Forestry students should advise with a committee of the Forestry faculty appointed for that purpose.

THE UNIVERSITY BULLETIN IS ISSUED BY THE UNIVERSITY OF MICHIGAN AS OFTEN AS EVERY SIX WEEKS DURING THE UNIVERSITY YEAR.

ENTERED AS SECOND-CLASS MATTER AT THE POSTOFFICE AT ANN ARBOR, MICHIGAN.

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The Annual Report of the President.

The Calendar of the University.

The Annual Announcements of the Departments of Literature, Science, and the Arts, of Engineering and Architecture, of Medicine and Surgery, and of Law, the School of Pharmacy, the Homœopathic Medical College, the College of Dental Surgery, the Graduate Department, and the Summer Session.

Other Announcements of the several departments of instruction, Reports of University officers, etc.